CE LIBRARY

JUN 28 1926

178

ENGINEERING AND
MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

McGraw-Hill Publishing Company, Inc. Price Twenty-five Cents Per Copy

June 26, 1926

Modernizing Tin Concentration Practice in Bolivia

By Robert D. Ferron

Up-to-date equipment and methods of recovery are gradually supplanting antiquated machinery and processes. Gravity separation is commonly used in handling simple cassiterite ores. Those of complex type offer opportunity to the metallurgist and manufacturer in devising ways of treating them

Mining Lepidolite in New Mexico

Method and cost of producing this ore of lithium near Embudo

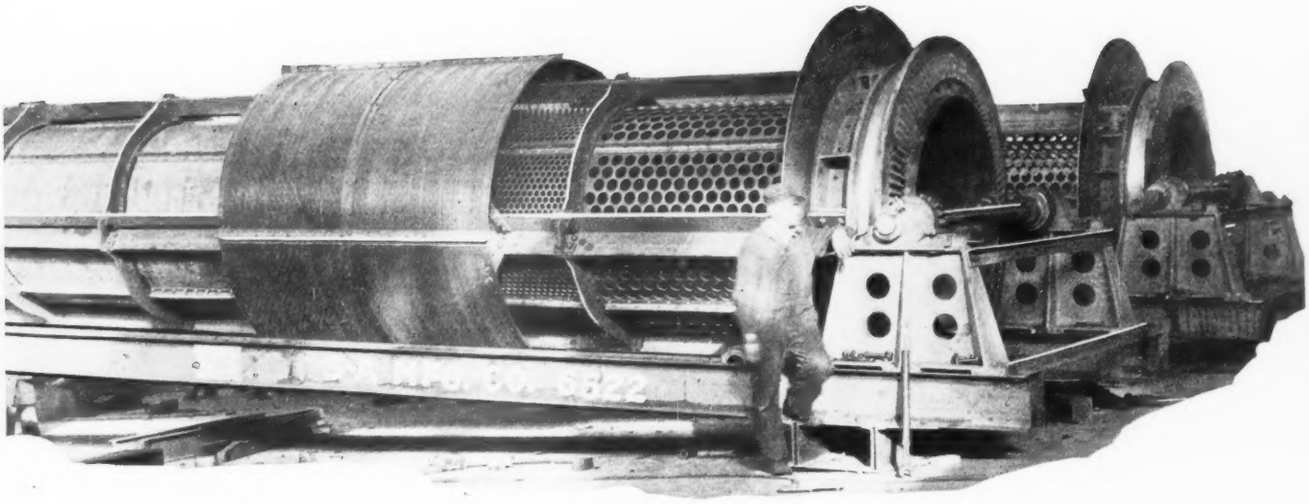
By Alford Roos

Some Adverse Influences of Glaciation on Mining

By Virgil R. D. Kirkham

Biography of James Madison Hill

S-A Screens—for every mining and milling duty

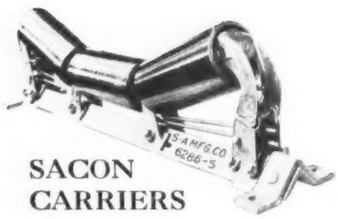


S-A engineers are competent to recommend the correct principles for the economical handling of your screening requirements.

Simply send a rough sketch showing your screening problem with an outline of your separating requirements, so that the recommendations of S-A engineers can be based on the nature of the materials, the size of the products required and the capacity desired.

S-A screening equipment is built in standard or special design for every mining and milling duty.

In grizzlies, bar screens, oscillating screens, revolving screens, etc., S-A products give long dependable service under adverse working conditions.



SACON CARRIERS

One of the new S-A Belt Conveyor Carriers. A light, strong, ball-bearing carrier with high pressure lubrication. S-A Carriers insure low power consumption and long belt life.

2

STEPHENS-ADAMSON
MFG. CO. AURORA, ILL.

Volume 121 New York, June 26, 1926 *Number* 26

ENGINEERING AND MINING JOURNAL-PRESS

J. E. SPURR, Editor

GEORGE J. YOUNG, Associate Editor, San Francisco, Calif. T. A. RICKARD, Contributing Editor, San Francisco, Calif.
A. H. HUBBELL, Managing Editor
E. H. ROBIE, A. B. PARSONS, ALBERT H. FAY, W. N. P. REED, Assistant Editors
Tenth Ave. at 36th St., New York, N. Y.
883 Mission St., San Francisco, Calif. Colorado Building, Washington, D. C.

Contents

*Illustrated Article

Editorials 1033
- Help From the Government
- Red-blooded He-men from the Mines
- Lead Prices Jump
- Must We Have an Industrial Depression?
- Felix the Cat—His Place in Industry
- Journalistic Problems
- Another Lost Mine

***Mining Engineers of Note** 1036
James Madison Hill

***Mining Lepidolite in New Mexico** 1037
By Alford Roos

***Modernizing Tin Concentration Practice in Bolivia** 1043
By Robert D. Ferron

***Some Adverse Influences of Glaciation on Mining** 1046
By Virgil R. D. Kirkham

Useful Operating Ideas 1050
- *Explosives Magazine Construction for Maximum Safety
  By R. M. Catlin
- *An Adjustable Drag-Type Classifier
  By H. A. Linke
- *Standard Hose Fittings at the United Verde
  By W. P. Goss

Searchlight Section 32-34

Professional Directory 35-37

Discussion 1052
- Problems of the Mineral Industry
- Sulphide Deposition at Joplin
- From One Who Knows

Consultation 1054
- Improving Precipitation of Silver From Cyanide Solutions
- Market for Chemical Manganese

Mining News 1055
- Copper Prospecting in Rhodesia
- Utah Mines Increase Production
- Mayo District, Yukon Territory
- British Columbia Water-Power
- Washington News
- Letters from Toronto, London, Johannesburg and Melbourne

Societies, Addresses and Reports 1062

Men You Should Know About 1063

Obituaries 1063

Recent Technical Publications 1064

New Machinery 1065

Markets 1067

Company Reports 1069

Mining Dividends 1070

Auction Sales of Mining Stocks 1070

Current Prices 1071

Mining Stocks 1072

What and Where to Buy 38-40

Advertising Index 42

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

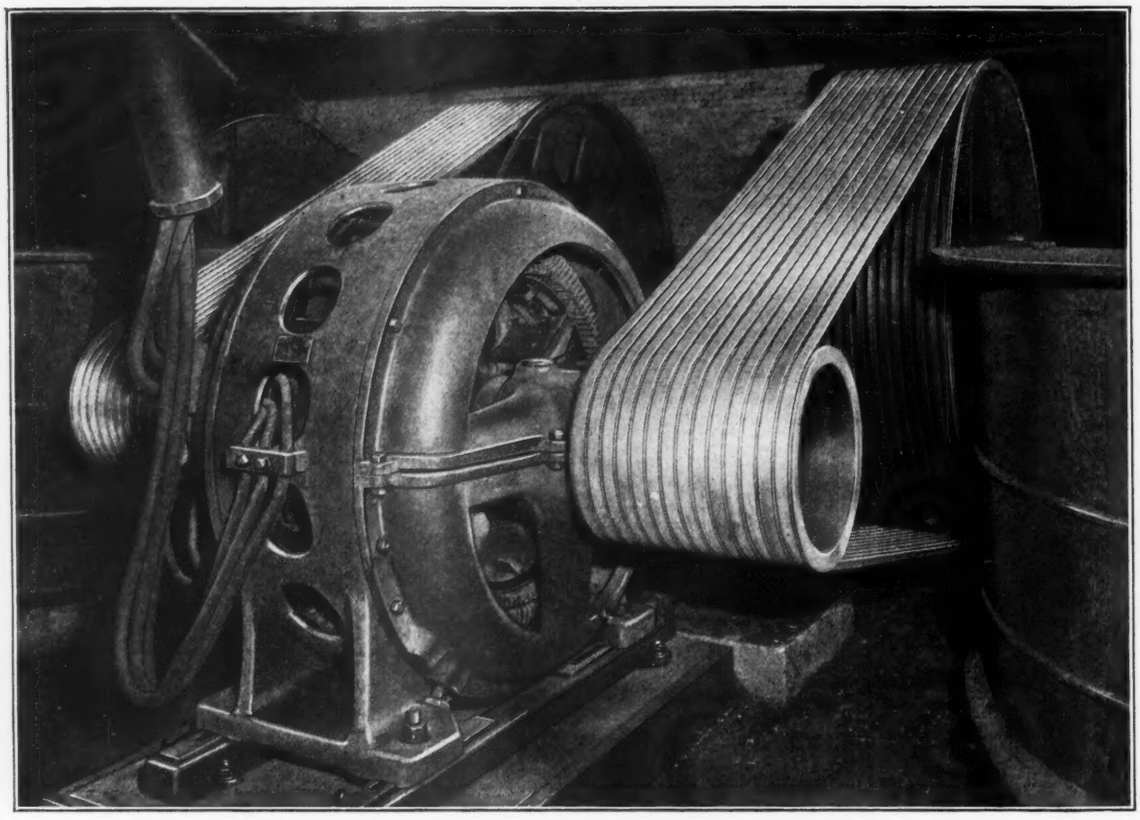
WASHINGTON, Colorado Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 16th and Parkway
CLEVELAND, Guardian Building
ST. LOUIS, Star Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

Cable Address: "Machinist, N. Y."
Copyright 1926
By McGraw-Hill Publishing Company, Inc.
Publishers of
Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal-Press
Ingeniería Internacional
Electrical World Electrical Merchandising
Bus Transportation Electric Railway Journal
Industrial Engineer Radio Retailing
Successful Methods
Journal of Electricity
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

The annual subscription rate in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Chili, Haiti and Paraguay, $5 per year. Extra foreign postage, $3 (total $8 or 34 shillings). Single copy, 25c. Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place.
Published weekly. Entered as second-class matter June 20, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

11,745 COPIES PRINTED THIS ISSUE

ALLIS TEXROPE DRIVE



The Proper Way to Drive Two-125 H.P. Beaters

The **TEXROPE DRIVE** came into the pulp and paper industry through an opening "Big as a Barn Door."

Because the industry needed, and did not have, a short center drive that was suitable for pulp mill conditions, that was not affected by moisture, that was positive, clean, trouble proof, silent and smooth, vibrationless and durable, the TEXROPE DRIVE, which HAS these characteristics, found a home.

Beaters, Jordans, Calender Stacks, Pumps, Fans, Stokers, etc.; fast or slow drives, wet or dry, hot or cold, clean or dusty, all are excellent TEXROPE applications.

Ask Our Nearest Office For Particulars.

ALLIS-CHALMERS

MILWAUKEE, WIS. U.S.A.

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 121 | New York, June 26, 1926 | *Number* 26

Help From the Government

THE McNary-Haugen farm-relief bill—a preposterous piece of legislation, which has long ago been analyzed unfavorably in these editorial columns—was denounced by Secretary Mellon as a measure whose primary benefit to the farmer would be paid by the general consumer, so that the general price of living would be raised. Whereupon not only members of the opposite party in the Senate, but also the more radical of his own party, arose to point out that his arguments apply equally well to the tariff—especially to such tariffs as that on aluminum, which taxes the nation, not for the benefit of an economic group or "bloc" but of a single company. How is it, they inquire, that the consumer, including the farmer of the West and South, should be taxed for the benefit of the manufacturer, and not be entitled to also receive government aid, the cost of which is to be paid by the "public"? And in spite of the clear folly of the farm-relief bill, the answer is not easy. To be sure, the farmers have had their part of tariff legislation, but since they produce a surplus over domestic requirements, this tariff differential is not operative, so they demand some new economic scheme of government subsidy which will raise the price for their products and increase their profits, and allow all of them to prosper.

The coal-mining industry is as badly off as the farmer, and for the same reason, yet it has not obtained the same amount of personal political sympathy or Congressional legislative efforts to raise the price of coal. "Why," it was pertinently asked at the recent meeting of the National Coal Association in Chicago, "does Congress yearn to fix a minimum price for farm products and a maximum price for coal?" The answer does not lie in economics but in politics. The farmers are powerful voters, the miners numerically unimportant and politically insignificant.

In the metal-mining industry the gold miners also sought government aid and subsidy, but because they were few in number their plea did not re-echo loudly in the halls of Congress. Likewise, those copper producers who were not flourishing so well as they would like have demanded in vain a government subsidy in the old respected form of a tariff.

The whole problem is a difficult one, but it is evident that all groups cannot be helped by the government—that is to say, the public—at the expense of the public. The net result would not affect the level of general prosperity—indeed, it would interfere with it on account of the ineffective working of industry-controlling machinery.

Should, then, some groups be subsidized and others left to shift for themselves in the stress of competition? Evidently this is not wholly equitable. The tariffs were originated to protect infant industries, with a view of making the whole country more independent and self-contained and giving employment to hosts of industrial workers. When such industries have grown to full stature, the wisdom and fairness of continued subsidies is doubtful.

The whole world has at present an epidemic of legislation attempting to influence natural economics, to secure special profits for special nations, and for special groups within the nations, the costs to be borne by those outside. Where these interlock, as they naturally tend to do—where A secures an economic legislative advantage over B and B over A, the result is complex and ineffectual. The aim of governments should be not to increase these subsidies, but gradually to reduce them. The slogan "Less government in business, and more business in the government" was a trenchant one. Let economic laws, so far as is safe, take their course. Thus in the end the greatest good to the greatest number will be achieved.

"Red-blooded He-men from the Mines"

THE CHANGE in the nature of mining engineers' conventions is lamented by a correspondent whose letter is published in the Bulletin of the Canadian Institute. Formerly, he says, in effect, the meetings of the Institute were something like: real miners got together and talked mines and mining: "geologists and professors were also there, and contributed some high-brow papers which nobody understood but which looked good in print." Now, however, according to the writer, all is changed: the meetings have no longer any kick. "They are not even bad enough to be interesting." The attendance is largely from government employees, college professors, and the representatives of mining-supply firms. And the crowning blow (the phrase is ours) is, for the banquet, the dinner-dance! In fifteen years, the lament continues, the Canadian Institute "will cease to be a Mining Institute. It will be a kind of Dorcas Society."

Wisely the correspondent does not sign his real name, hiding from the righteous wrath of those whom he regards with ennui, under the pen-name of Old-Timer. What he wants to do is to move the Institute headquarters from Montreal to some place nearer the mines: have the annual meeting in the summer: and have an old-time banquet (no ladies); also get more real technical stuff on mining from the big mining companies.

Comment upon such a letter would be as superfluous as upon Secretary Mellon's recent analysis of the McNary-Haugen farm-relief bill. The comment is all included in the communication. The world is small and problems parallel; and some analogies to the gentle evolution of which the writer complains in Canada might be traced on the south side of the longest unfortified frontier in the world. More definite discussion is delegated to some other correspondent, who may, if his communication appears reasonable, also observe discretion (if his real name be imparted, under the most solemn promises of secrecy and protection), and be privileged to write behind the armor of a pen-name.

Lead Prices Jump

BUYER PSYCHOLOGY rather than any fundamental change in respect to mine production or manufacturing consumption is responsible for the sudden jump in the price of lead in New York from 7.65c. on June 7, to 8.30c. on June 16. This followed a steady decline since November, 1925, when the price for several weeks was 9.75c.

A month ago producers were urging buyers to take lead at 7.65c.; they frankly advised them that, unless consumers bought to meet their requirements for a reasonable period ahead, a scarcity of metal would develop and the price would skyrocket. For various reasons the producing and smelting companies are averse to sharp and drastic fluctuations in the price; they fare better with a comparatively stable market, even if the average price be slightly lower.

But consumers, speaking generally, would not buy. Doubtless, they looked back at the curve of prices for the last three years and found that valleys in May or June were followed by steady climbs to crests near the end of the year. They reasoned that the same thing was likely to happen again; but they did not know how deep the valley for 1926 would be. They wanted to be sure that the bottom had been reached, and meantime they bought only for their early needs. This applies not only to the immediate buyer but to his customers as well.

Early this month some strength developed in London, and many consumers in the domestic market started to buy. On June 10 the American Smelting & Refining Co. increased its price $3 per ton. That seemed to convince buyers that the time had come to get into the market, and sellers were deluged with inquiries. Three more times during the week ended June 16 the Smelting company increased its price—each time in an effort to keep up with the "outside" market. Many of the identical consumers who could not be interested in 100 tons at 7.65c. suddenly found that they needed lead badly and clamored for 500 to 600 tons at 8.25c. And frequently in vain; for the producers have little metal available for June and July.

Exactly what the producers had foreseen and warned against has come to pass. Probably the immediate cause of the turn was buying in London for Continental account—German consumers being particularly active; by speculators who were covering short sales; and by British dealers who are astute followers of the world markets and buy when they think metal is cheap. The stiffening of the London quotation doubtless lighted the fuse over here.

The miner of lead ore, of course, is more concerned with the broader aspects of the situation. He is much more interested in what the price is going to average during the next year than in the reasons for a sudden spurt.

Prudent people do not prophesy about lead, especially in print; at the same time, some of the factors that may have a bearing on the future course of the market may be enumerated. Those who do not expect a repetition of the climb to the dizzy price of last November point out that the world's stocks in producers' hands are somewhat larger than they were; that the mines, supplemented by new enterprises, are prepared to produce more lead than they were a year ago, if it is needed; that the partial paralysis of industry in Great Britain will tend to lessen the world's net consumption; and that some contraction in the scale of American industrial and manufacturing activity is forecast by economists.

On the other hand, it can be said that the stocks, not only of raw lead but of all kinds of lead products in the hands of American manufacturers, are extremely low. If, as appears entirely likely, the market continues an upward trend, buying to build up these stocks should develop, even if there is some moderation in industry. Incidentally, the second largest use of lead—for the covering of electric cables—is largely independent of general industrial activity, because the product is used mostly in public-utility installations. Reports indicate a steady, if slow, improvement in Germany, the principal Continental consumer; and the settlement of the British coal strike should be followed by a stimulation in manufacturing to make up for lost time. Moreover, there is no huge excess potential mine production hanging over the market, as is the case with copper. Such are the arguments of those who foresee a firm market for lead at between 8 and 9c. during the remainder of the year.

Must We Have an Industrial Depression?

PREDICTIONS made late last winter that the 1925 wave of prosperity in the United States had reached its crest and that business was likely to slow up in the current year have so far proved unduly pessimistic. Apparently the principal reasoning on which they were founded was that what goes up must come down, and that precedent indicated a recession in industrial activity after the heights to which it had risen. The stock market broke badly, commodity prices fell, and consumers of crude metals and other raw materials postponed their buying as long as possible, their customers, in turn, doing the same, though apparently they bought as much in small lots for early delivery as they had previously bought in a few large lots for forward shipment. Economists did not, in general, share the popular view, seeing nothing to fear in the fundamental situation, and pointing out that the unfavorable conditions existing in early spring were much the same as obtained last spring and the spring before, and that so long as money was cheap and certain other conditions continued favorable, an industrial depression of moment was not to be expected. Their view seems to have been justified by current events, for certainly buying, even though it be more of the hand-to-mouth character than last year, seems to be again as active as ever. The stock market is again strong, commodity prices have a firmer tendency, as exemplified particularly in the case of metals in the last two or three weeks, and there is a general feeling of optimism for the last half of the year. Apparently, 1926 is to be just as good a year as 1925; perhaps better.

The fact remains, it may be argued, that, judged by past performances, we have been for many months in the upper half of the curve indicating industrial activity and prosperity. If business goes in cycles, as it has in the past, things should get worse rather than better in the next year or two. Caution is therefore indicated, but can we go too much on what has taken place in the past; is it not possible for the United States

to be continually prosperous for the next several years, though of course, with moderate reactions from time to time? Interest rates are low and promise to continue so; there is no unemployment problem and wages are high, thanks in part to a restrictive immigration policy; and the people are living more efficiently than ever before owing to the general use of machinery, to the utilization of natural resources, and, perhaps, to prohibition. A larger proportion of the people of the United States have the means to buy things. Formerly the wealthy class bought all it wanted to; the middle class was a moderate consumer; and the populous lower class was able to buy only limited amounts of essentials. Nowadays the first two classes perhaps buy no more than before, but the large lower class is immeasurably better off, so the total buying power is greatly expanded, and it is buying that makes industrial activity and prosperity. Why may it not continue?

Felix the Cat—His Place in Industry

THE WAREHOUSE CAT — a theme hitherto neglected in the songs and stories of the business press—has been selected as the topic of an article that is soon to be printed by a contemporary publication that concerns itself with merchandise storage and distribution. Thus the humble feline—once sacred in ancient Egypt—is to receive his proper due. For the cat plays an essential rôle in industry. But not in the mining industry, at first thought it seems. Rats the mine may have, but never cats. One mine that sticks in the recollection had black rats and white rats and, of course, black and white rats, but no cats. Mills, too, seem to lack the almost ubiquitous cat. Likewise smelters, though one smelter there was at least that had pigs—not of metal but the squealing quadruped—pigs that seemed to enjoy the sulphurous atmosphere of the charging floor.

Maintenance of a mine warehouse seems possible without the services of a cat, few of the supplies carried being fancied by rodents and other similar beasts of prey. But in the commissary or company store a niche has been found for Felix, and so many niches of this sort there are that it can truthfully be asserted that the cat has a definite place in mining—as the guardian of the supplies that go to make the miner. Thus the selection of the proper cat is possibly a matter worthy of study and attention, and if this be a duty that falls within the purview of the purchasing agent he may find it interesting to read the article in *Distribution and Warehousing* of July 1, to which reference has been made.

Journalistic Problems

AN ESSENTIAL PART of modern publishing is advertising: and so scientific and necessary has advertising become in the modern world that it is sometimes hard to distinguish, in the case of a multitude of periodicals, whether the editorial pages are a vehicle for the advertising, or the advertising pages are a carrier for the editorial text. The industry or other clientele for whom a paper is run, and which in the first and last analysis supports it, and to which in the first and last analysis it belongs, is of the former opinion: among advertisers there are here and there those who adhere to the latter theory, though most of them do not.

Indeed, there are numerous publications whose indifferent "reading matter" is simply intended as gas to inflate the advertising balloon; their name is legion, but their influence is slight. At the opposite extreme are the rare periodicals which do not carry advertising, or which are indifferent to it; but these must of necessity be endowed or subsidized, and may therefore serve for special and possibly pernicious propaganda. The wholesome middle-of-the-road periodicals maintain the editorial dignity, independence, and devotion to their subscribers' fields which characterize all those journals which the public holds in respect; and these serve as such an adequate vehicle for legitimate and wholesome sales publicity that they have no difficulty in getting income therefrom, to pay the bills. The editor's job is to create such a paper, to serve his industry. The advertising department in such periodicals is distinct from the editorial one; each is independent of the other —each doing its best for its special field. The editor does not sell advertising. "Keeping one eye on the subscriber and the other on the advertiser makes an editor cross-eyed," the editor of *The Nation's Business* said in a recent editorial. Indeed, in such a case, the obliquity is likely to become permanent. Amphibians in the shape of editors who keep one eye or both eyes on the advertiser, or of advertising managers who put in too much time worrying about editorial policies, are usually competent neither on sea nor land. Experienced advertisers seek a good advertising medium or carrier—one that covers the industry and is respected by it. They do not expect indirect advertising in the editorial columns; and those that do, do not get it, in a periodical of dignity and standing. Space in the advertising pages is for sale for such sales talks as in the opinion of the publishers will help the industry, and no other kind. The rental for the space is so adjusted by publishing and advertising experts that it is worth the figure asked. If such an investment does not bring results to the advertiser, he should investigate his method of presentation; selling in print is as much a fine art as selling in person.

Another Lost Mine

THIS TIME it is a copper mine in southeastern Missouri. The mine, as most lost mines are, is said to be very rich. According to the *Kansas City Star*, tradition of it comes from New Orleans via Eminence, Shannon County, Mo. The latter part of the eighteenth century, when Missouri still was part of the Louisiana Territory under the French, and St. Louis was a village, a man named Slater, from Missouri, appeared at New Orleans every spring with a raft loaded down with rich copper matte and sold it there, the record of the sales still being preserved. Slater made his last trip in 1813 and then disappeared. It is probable he was killed by Indians. With his disappearance passed all human knowledge of the copper mine he had worked so long.

Shannon County is on the south slope of the Ozark Mountains, whence it would have been possible to make small shipments by an all-river route to New Orleans. Copper does exist in small amounts in Shannon, Phelps, St. Francois, Madison, and perhaps other counties, but the amount produced is negligible. Even though this lost mine should be discovered some day, there is no reason to fear any appreciable glut of the copper market.

Mining Lepidolite in New Mexico

Production of Lithia Ores in Pegmatite Near Embudo—Methods and Costs—Genetic Theory of Occurrence Applied to Finding New Orebodies

By Alford Roos
Mining Engineer, Vanadium, New Mexico

Alford Roos

IN THE extreme northern part of New Mexico, near the Colorado line, and close to the historical and picturesque Indian village of Taos, is an important and flourishing, if little-known non-metallic mining industry. This is the mining of lepidolite by the Mineral Mining and Milling Corporation, together with the mining of spodumene by Joseph Peyer.

The mines are situated on a pegmatitic body very narrowly restricted to one locality, which lies about twelve miles easterly from the town of Embudo (meaning "funnel" in Spanish), on the Denver and Rio Grande Western R.R. The line is narrow-gage, popularly known as the "Chile Line" because it passes through a country almost exclusively inhabited by a Spanish and Indian population whose principal industry is the cultivation of the red chile, the long brilliant scarlet festoons of which literally cover the square adobe dwellings along the countryside.

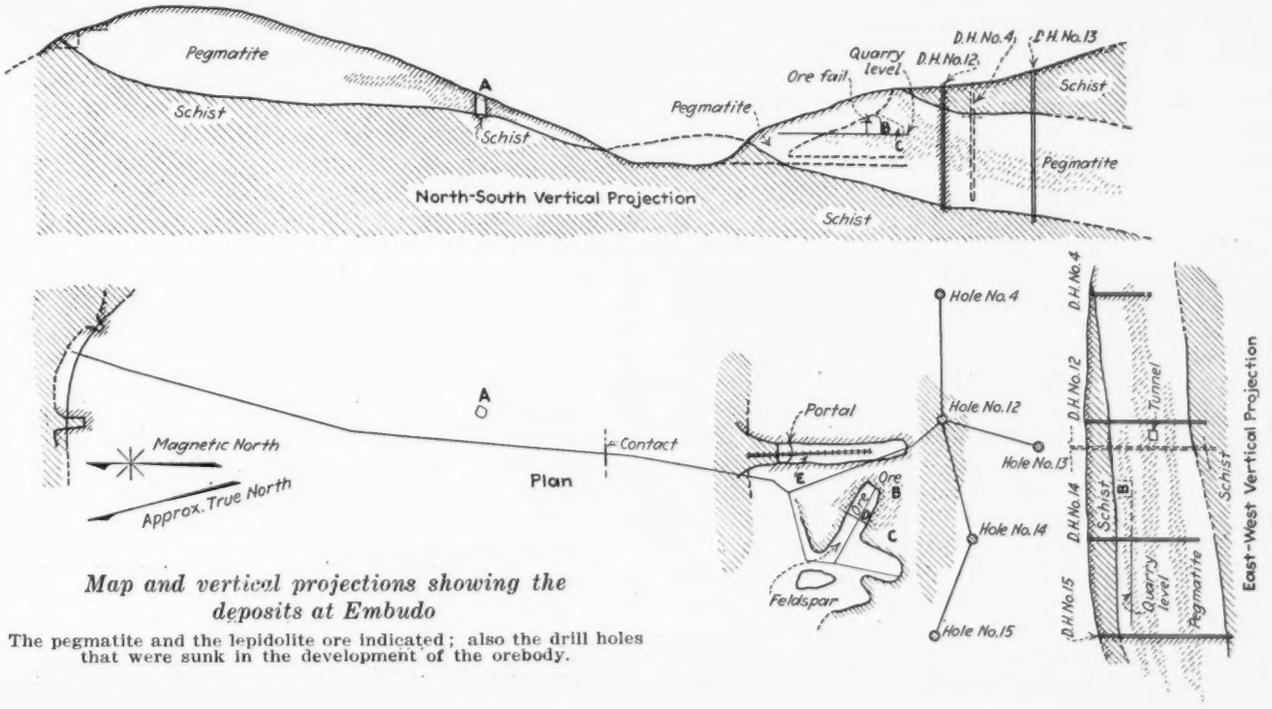
The mines are about half a mile from the banks of the Embudo River, which empties into the Rio Grande at Embudo station. The Embudo River is a permanent stream, down which, in normal years, millions of railroad ties are floated into the Rio Grande.

Region of Scenic Grandeur

Both the Rio Grande and the Embudo River here flow through deep and narrow gorges: the Rio Grande through barren, bleak, basaltic lava flows devoid of vegetation; and the Embudo, from the mines beyond, through a widely tumbled, forest-clad region, beautiful in scenic grandeur, and crossed by many narrow agricultural valleys, farmed by Indians.

The area, known as the Copper Hill mining district, has never been developed for important metal mining, although a little copper ore, together with a small tonnage of high-grade wolframite, has been shipped. The ruins of a well-equipped copper concentrator lie about two miles from the lithia deposits, and considerable capital evidently was spent in developing and equipping these properties.

The quartz outcrop of the pegmatite has long been known, but not as such. From time to time for many years the ground had been located and relocated on the assumption that a silver or gold mine might be developed. Location shafts had penetrated through the white quartz outcrops and into the lepidolite and spodumene below. However, these minerals remained unrecognized until about 1919, when by accident a prospector happened that way who had at one time worked in the lepidolite and spodumene mines in the Black Hills of Dakota. He immediately recognized the minerals, and



Map and vertical projections showing the deposits at Embudo

The pegmatite and the lepidolite ore indicated; also the drill holes that were sunk in the development of the orebody.

Mining Engineers of Note

James Madison Hill

JAMES MADISON HILL, mining engineer, who for almost twenty years has been connected with the U. S. Geological Survey, was born in Chicago in 1884. His father, a native of Skowhegan, Maine, and his mother, a Bostonian, went to that city in the early days. The elder Hill was a lawyer and real-estate operator for many years in Chicago, and laid out one of the suburban divisions that is now in the center of the South Side. Mr. Hill attended the public schools of the city and then the University School at Cleveland, Ohio, for two years, and was graduated from the Chicago Manual Training School in 1901. The following year he went to the University of Chicago. There he specialized in geology, also taking considerable interest in chemistry, physics, and the natural sciences. Upon graduation in 1906 he received a scholarship in geology, but was unable to take full advantage of this excellent opportunity for further study.

Between the dates of his entrance and his graduation at the University of Chicago Mr. Hill spent several months at Armour Institute of Technology and at the Michigan College of Mines. In September, 1907, he received his appointment with the U. S. Geological Survey. His first few summers were spent in examining mining claims in the National Forests. His winters in Washington were most valuable, for he was permitted to work directly under Waldemar Lindgren, and for a while, during the preparation of the first draft of the material that was later published as Bulletin 507, "Mining Districts of the Western United States," he worked in the same office with Lindgren. His principal contributions to the geologic knowledge of the United States are found in a "Professional Paper" on the geology of Gilpin and Clear Creek counties, Colo., of which he was joint author with Edson S. Bastin, and in two bulletins giving the results of reconnaissance trips in Nevada. He is the author of many geologic reports on mineral deposits in Colorado, New Mexico, Arizona and California. He early became interested in the economics of minerals and wrote many of the chapters of "Mineral Resources" that dealt with the platinum metals, bauxite and aluminum, magnesite, barytes, strontium, mineral paints, gold, silver, copper, lead, and zinc in California, in Oregon, and in the Eastern states. As specialist on platinum metals and bauxite and aluminum, he rendered assistance to the War Industries Board, the War Trade Board, the Shipping Board, and other federal agencies during the period of the recent war with Germany. For a number of years he has prepared the material on platinum metals and bauxite for the Annual Review Number of *Engineering and Mining Journal-Press*, and written papers on these subjects, as well as on tin, which appear in "Marketing of Metals and Minerals" and "Political and Commercial Geology."

Mr. Hill is a member of the Washington Academy of Sciences, the Geological Society of America, the Society of Economic Geologists, and the American Institute of Mining and Metallurgical Engineers. Since going to California he has taken much interest in the Boy Scout movement and he is at present on the Berkeley Council, Boy Scouts of America. Mr. Hill took charge of the San Francisco office of the Mineral Resources Division in 1920.

if added in greater quantities an opacifying effect was produced. Enequest, on discovering this, took out his U. S. Patent No. 1,261,015. Later, other researchers discovered that lepidolite materially toughened glass and caused a resistance to shattering. More recently the discovery has been made, and put to practical use, that lepidolite can be used as an excellent substitute for high-grade fluorspar in the glass trade, and in white table tops, in enamels, and in opaque glasses. In some respects, such as its toughening quality, it is superior to fluorite. In an experiment which I conducted it was found that pure lilac lepidolite fused with great difficulty in a high temperature assay muffle, and when it did fuse it quickly fluxed and cut through both crucible and muffle. The fused product when cool was a snow-white, opaque glass, brilliant in luster and quite tough.

The price of ground lepidolite has varied from $30 to $45 a ton, f.o.b. Wheeling, W. Va. The freight from Embudo to Wheeling is about $14.

View of mining operations near Embudo. Glory hole indicated by "A" and open cut by "B"

Methods and Costs of Mining

Mining at the deposit described is done by stripping, followed by either open-cut quarrying or glory-holing. In the last-named operation the ore is broken down into a crater in the base of which is a shaft leading into a tunnel, whence it is trammed to the stockpile. Holes are put down to a depth of 12 ft., both with machine drills and hand churn-drills. As the lepidolite lenses often attain a vertical thickness of 25 ft. and more, mining costs are low. Even allowing for a considerable program of exploratory work and stripping, the cost of the ore delivered on the stockpile does not often exceed $1.75 a ton. Taking into account this exploratory work and stripping and development costs, it is doubtful if the other lepidolite deposits of the United States can compete with this low production cost. As the deposit is on the side of a steep hill, no hoisting is necessary and will not be necessary for several years. The overburden consisted at first of 2 ft. of soil, and from 2 to 8 ft. of white quartz; but now, as the work progresses into the hill, an increased amount of schist must be stripped. Eventually the mine will develop into an underground quarry with supporting pillars.

The rock drills easily; and although the lepidolite is soft, the drills become dull with surprising quickness. The air-drill bits are of the four-winged cruciform type, and all holes are drilled dry. As almost all the holes are vertical, columns and cradles are not used. The ore is hauled by wagon by contractors at a cost of $2.50 a ton. The explosive used is T.N.T., with a priming charge of 60 per cent ammonium dynamite. In shooting, the lepidolite, being very tough, breaks off in large blocks, with practically no fines whatever.

The equipment consists of dry Ingersoll-Rand jackhammers and a 200-ft. Chicago-Pneumatic, straight-line, hot-head compressor. The rotary shot core drill is no longer in use.

Geology and Mineralogy of the Deposit

In the following observations and data pertaining to the Embudo pegmatite, gathered, as they were, over a period of one year from fourteen trips of a week's duration each, it is my hope that the deductions and the observations on the various phenomena on which they are based will add something to our insufficient knowledge of that puzzling group of rocks—the pegmatites. Though some of the observations have led me to advance theories on the genesis and natural history of these bodies, or rather on the one near Embudo, which seem to disagree with some of those eminent investigators who have gone before, and with some of those contemporaries who are now working on the problem, it is quite pardonable, I believe, to hold to a divergence in views on some points. Frank Hess, of the U. S. Geological Survey, has naïvely said: "All are agreed on the one point: that the pegmatites are of igneous origin; and from that point there is a considerable diversity of opinion."

However, it must be admitted that the field of datum is narrow, since the Embudo pegmatitic body is the sole criterion of these deductions. However, since the practical utilization of these postulations have had successful application in prospecting for new lepidolite lenses, they should receive consideration in contemplation of other pegmatites and their exploitation. The scope of this paper will not permit an extensive elabora-

with local associates located the ground. They elicited the interest of Henry H. Wood, of New York City, now deceased, who sent down J. L. Danziger, with the result that the mine was taken over on a bond and lease, at a reported price of $150,000 with guaranteed royalty of $10,000 a year.

Explored by Core Drilling

During the first two years $70,000 was spent in building a camp, installing mining equipment, and doing several hundred feet of development work on the deposit. A steel-shot core drill was sent out from New York by express, and fifteen holes were put down, the deepest of which reached 103 ft. Unfortunately, during this period no geological or engineering talent was engaged, and the results of the development were largely negative. Some lepidolite was exposed, and about 200 tons was shipped, but no large bodies of the mineral were encountered. This was due partly to the insufficient knowledge of the habit and normal position of segregation of the mineral within the pegmatite. Later this problem was worked out, with the result, thereafter, that prospecting invariably met with uniform and gratifying results. While the core-drill performed well it was regrettable that poor and incomplete records of the drilling were kept, and the cores themselves were piled carelessly in a heap with no tags for identification attached to them. However, the incomplete logs proved to be very valuable subsequently. In 1922 I was engaged for a year, as geologist and consulting engineer, to make monthly trips of inspection to the property and to exercise general supervision and direction of the development. At the close of 1923 large reserves of a good grade of lepidolite were developed and two to three carloads per week were shipped to Wheeling, W. Va., and other points.

By this time the mine was able to produce a far greater tonnage; but difficulties were encountered in finding a market for a larger production. At present the mine is in a healthy condition, readily able to produce all that the domestic market can now absorb, and plans are being realized in the construction of a grinding plant near the mine, so that a finished product will be made. By this means an important saving in transport will be effected, since heretofore most of the ore has been shipped to the Wheeling Pulverizing Works, at Wheeling, W. Va., where it was ground to various meshes suitable to the requirements of the trade.

Properties of Lepidolite

Lepidolite, sometimes called lithia-mica, and spodumene and amblygonite are the minerals from which lithium, the lightest of all the metals, and its compounds are derived. Though widely distributed over the earth, the United States produces by far the greatest amount. Production is practically confined to the property under discussion; to the Black Hills of South Dakota; and to the neighborhood of Pala, San Diego County, Calif.

Lepidolite varies in color from white to tints of lilac and green. A deep, beautiful lilac is the typical and characteristic color of the Embudo lepidolite. Although it is a mica, the size of the plates rarely exceeds a quarter of an inch in any dimension. Often at Embudo masses of gray or ruby-colored lepidolite, which show no crystallization whatever, are mined; they are virtually non-crystalline, semi-transparent glass. The material is always characteristically soft, its hardness being 2.5 to 4, and it is this feature of softness which affords a fairly reliable field test. If in a pegmatitic body a material is found which is scaly-granular or massive, that can be scratched with a burnt common nail, and that exhibits, in drawing the nail across the material, a very soft, smooth, ungrating, unharsh feeling, it is fairly safe to assume it is lepidolite. This method is much used at this property to ascertain what is and what is not lepidolite, and is found very practical where there is a large number of different minerals, all of which vary in color and appearance and at times closely resemble each other. None of the other common pegmatite minerals have this characteristic, except other micas.

Primarily, lepidolite is a metasilicate, but might more specifically be termed a "lithia-fluorine-potassium-aluminum" silicate, as these elements always are present. The fluorine, lithium, potassium, and small sodium content vary in percentage in different deposits and even in the same body, though the silica and alumina remain quite constant. A tabulated list of analyses of lepidolite ores from the Embudo occurrence, made in 1922, is shown in the accompanying table.

Table I—Typical Analyses of Lepidolite

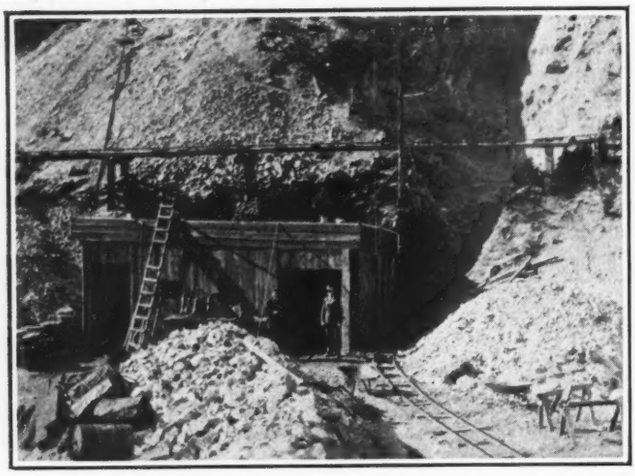
Silica	55.62	58.57	55.70	55.52	54.80	54.53	58.26	62.96*	62.06
Alumina	27.38	24.43	26.70	27.54	26.51	26.01	25.26	23.64	28.61
Potassium Oxide	7.09	11.45	7.81	10.89	9.27	10.52	11.56	6.02	1.09
Sodium Oxide	4.17	0.87	4.30	0.50	3.57	1.44	.....	1.12	1.64
Magnesium Oxide	....	.....	0.10	.....	0.52	0.05	.....	.....	0.05
Lithium Oxide	2.36	1.55	2.25	1.23	2.34	3.21	1.20	1.03	6.33
Flourine	1.45	.....	2.92	.....	2.35	3.56	1.43	0.25	0.96
Manganese Oxide Mn_3O_4	0.68	0.63	trace	0.91	trace	0.45	1.30	.....	trace
Ferric Oxide	0.07	0.06	0.05	0.04	0.55	0.04	0.06	0.26	0.04
Magnetic Iron	0.005	....	0.005	....	0.003	0.005	....	....	....
Calcium Oxide	....	....	0.15	....	0.25	0.05	....	0.15	0.05
Ignition Loss	0.80	2.70	0.30	....	0.22	0.34 3.18†	2.68	2.88	0.80

*Gray Lepidolite †At 500 deg. and 1,000 deg. C. respectively.

At rare intervals, at the adjoining Joseph Peyer property, in which spodumene is the principal product, in vugs and cavities occur apple-green, transparent crystals, which are too hard for lepidolite and are perhaps crystals of spodumene. This latter mineral is always present in greater or lesser amounts with the lepidolite, generally occurring as massive sheets between blocks of silica. It is glossy, white and hard, to chalky-white and earthy, often having a greenish cast and invariably containing crystals of fluorite. No attempt is made to eliminate this from the shipped ores.

Lepidolite and spodumene ores are mined for their lithia content. This element, in the form of a hydroxide compound, is used in large quantity in alkaline storage batteries, of which the Edison is a well-known type. At the present time, next to the glass industry, this use consumes the largest tonnage of lithium ores. In 1923 Thomas Edison purchased a lithia mine in the Black Hills so as to control his own source of supply. The bromides and iodides of lithia are used in photography, and the cyanide of lithia is used in Roentgen-ray and other research experiments. Carbonate of lithia is used in fireworks and signal lights, but all these last-named compounds consume a negligible quantity of the total tonnage of lithia ores.

All of the Embudo production goes into the glass trade, which consumes by far the bulk of the world's tonnage. It was in 1918 that Erik W. Enequest discovered that by adding lepidolite to glass "batches" a marked reduction in viscosity was obtained; also, that



Portal of glory-hole tunnel at the lepidolite mine near Embudo, N. M.

tion of observations and theories; consideration will be confined to salient features.

The Embudo pegmatite body seems to be a single, self-contained unit, except where a severance by erosion has detached wings or sections; indeed, the core-drill holes as logged seem to indicate that the confines in general are almost certainly defined and known. Were only two more holes drilled, they might actually prove that here we have a pegmatitic body, isolated and without continuation or extensions, into unfathomable depths, and entirely surrounded by an alien basic sea of other rocks. With such a conception, of course, pegmatites cannot logically be termed dikes—that is, as J. E. Spurr has postulated them; neither can they be called veindikes, or veins.

The mother rock-mass of the region in which this pegmatite occurs is a typical non-porphyritic, plutonic or hypabyssal rock, which might be termed a biotite-quartz schist. It is of deep-seated origin, holocrystalline except in places where there is a suggestion of an approach to a glassy residue; but, on the whole, the crystallization is uniform. It is entirely fresh and unaltered, with the sole exception of some places near the upper contact with the pegmatite. In color it is black, to gray and greenish. None of the sedimentaries being present in the district, no data are available by which some indication of its position in the geological scale could be determined; however, it is undoubtedly of Pre-Cambrian age.

Chemically, this plutonic rock is high in potassic contents, and also in silica and alumina, analogous in these respects to the pegmatite which it envelops, but contrasting sharply with the latter in that it is also high in magnesia and iron, of which there is an almost total absence in the pegmatite taken as a whole. The latter also is much higher in sodic content, due to the considerable element of pink albite.

The Embudo pegmatite is flat-lying and almost blanket-like in position, dipping at a general angle of only 11 deg. to the south, and attaining, normally, in its central axis and where not eroded, a thickness of 70 ft. vertical, between upper and lower confining walls, but thinning out, lens-like, toward its lateral confines. Easterly and westerly its position is horizontal; in extent more than 2,000 ft. In its general shape it is lenticular, feathering out and thinning on the north and to the east and the west. Its definition in the south is more obscure, but the core-drilling has shown its position to be uniform with respect to its other known limitations.

Well-Defined Schist Contact

Generally, and especially in the south, which is called the Pink Hill as distinguished from the north, or Gray Hill, the contact between the schist is exceedingly sharp and well defined. Only in certain spots on the north, or Gray Hill, does the pegmatite contact take on a character which indicates a general merging or indefinite limitation between the two orebodies.

At a first inspection, the outstanding feature which strikes the observer is that practically all the outer visible portions are massive white quartz. The drill holes and the open quarries show that in general the upper and lower zones are of this material, whereas the interior portions are composed of a heterogeneous assembly of pink albite, microcline, orthoclase, lepidolite and spodumene, and another generation of quartz. It is to be noted that with but a single exception none of the constituting minerals, not even the more easily alterable soda-lime albite, are in the least altered. The exception is the spodumene, which on exposure to the air for a few weeks disintegrates and crumbles into an earthy character. It is suspected that disintegration of the spodumene has already gone far, requiring only the touch of air and exposure to crumble it completely. It seems almost certain that no replacement or chemical change has taken place since solidification. All penetration and interpenetration and apparent replacement and invasion of one mineral with respect to another must have taken place while all were in a molten, gelatinous, or gaseous condition and at a high temperature and progressive concentration of water and volatile constituents.

I believe that the pegmatitic body is a non-invading, acid excretion from a crystallizing magma, the constituting minerals having but one normal generation and habit; whereas the pegmatite has a succession of generations, even of the same minerals. Accordingly, it seems reasonable and logical to assume that the order and sequence of these generations, modified, it is true, by other factors, is based on the fusibility and freezing temperatures of the several minerals. Thus, quartz normally fusing at 1,430 deg., and orthoclase and microcline following at 1,175 deg., albite, spodumene, and lepidolite will follow in order. With some exceptions, observations seem to confirm this hypothesis. The modifying influence can be taken as the higher water and gaseous content of the pegmatite, as compared with the mother magma. Whether or not the mother magma or the pegmatite cooled first seems not so important. Both might very well have been molten at the time of segregation, and very probably were so. Thereafter, both bodies and the several constituent minerals may have solidified at their normal freezing point, the modifying gases and mineralizers no doubt exercising an exothermic action, which with increasing concentration of these caused enough increase of temperature to again fuse some of the earlier solidified minerals. Certain observations which will hereafter be described seem to bear this supposition out.

Hypothesis of Ore Genesis

Going back to the fundamental and basic reason for the occurrence of an alien pegmatitic body within a far vaster mass of the mother magma, it seems that if a

reasonable and logical hypothesis can be arrived at, all the other phenomena will fit in without discord and go far to clear up the generally admitted obscurities. Going back to a fundamental condition, it can hardly be conceived other than that originally there was one single uniform magmatic condition at a period when no pegmatitic segregation had started. Cooling must have taken place over vast periods of time, in these deep-seated abyssal bodies; and hence, according to the general chemical content of the mass, one or more minerals, which in their single or combined analysis most nearly corresponded with the chemical make-up of the whole, must have started to solidify and crystallize out. Confirming the conception as to this first step, it will be observed that true pegmatites invariably occur in deep-seated abyssal rocks. But, of course, the probabilities were that no single mineral, or group of minerals, would exactly answer in chemical composition the chemical composition of the whole mass: there must have been a misfitting residue. Increasingly, there must have been a concentration of these misfitting elements, which, according to the laws of affinity, must over vast periods of time have gathered into segregated areas. We know that the volatile elements, such as fluorine, water and other gases, were present in concentrated quantities in this area, and the chemical content of these minerals so indicates. At this stage one can conceive of the aspect as analogous to a gaseous or highly fluid globose, in an ever more viscous mass.

At this stage only, and up to this point, the future pegmatite might very well have been an invading migrating body, and just so long as the mother magma had not become frozen. This can well harmonize with those who do regard the pegmatites as essentially an invading body, but does not so well harmonize with the veindike theory, so brilliantly promulgated by Spurr, in which a fluid rends its vagrant course through a solid mass. Also, this conception harmonizes perfectly with those conditions where no invasion by a mobile body is apparent, as is so evident in the Embudo pegmatite. However, there was probably until the final stage of consolidation of the pegmatite an inter-invasion or migration of portions of the pegmatite within its own body. This explains the marked flow structure and texture of the gray lepidolite on the North Hill at Embudo. Of course, the ever-present fluorine and water kept the mass fluid even at a temperature lower normally than the freezing point of its several minerals.

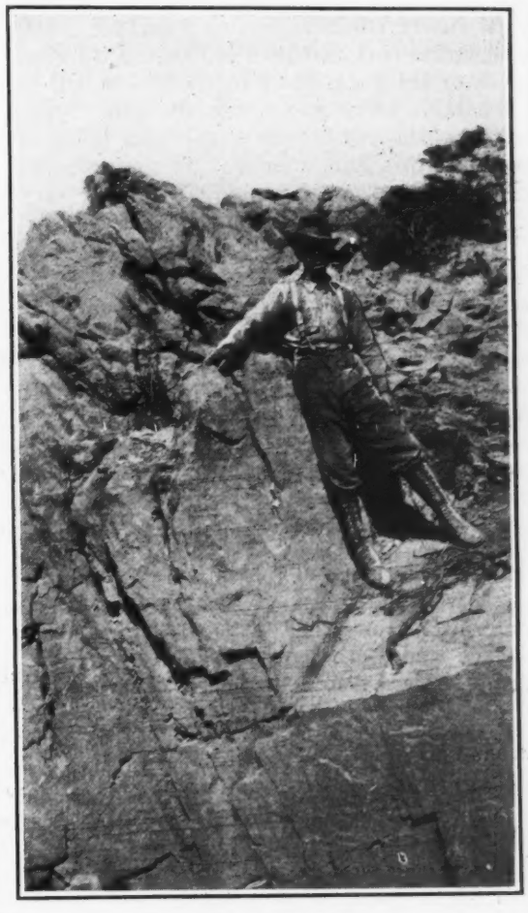
Following this viewpoint further, it is safe to say that the mother magma solidified at an earlier period; hence the outer confines of the future pegmatite must have been the first to take on a lower or freezing temperature. This being true, it is natural that a crystallizing out of silica must have occurred at the outer zones of the pegmatite, resulting from the contact with the cooling mother magma. This is exactly what did happen in the Embudo pegmatite, as it is almost invariably bounded by thick confining bands of white quartz. This is logical, since quartz has a lower normal freezing point than any of the other minerals making up the pegmatite.

Next in the order of increasing fusibility are the potassic feldspars, orthoclase and microcline. At Embudo we find massive zones of microcline and orthoclase bounding the inner zone of white quartz. This is as it should be in this line of reasoning. At this stage more and more fluorine and water must have been present in the remaining unsolidified mass, causing an increased fluidity, with a marked increasing tendency to fluxing.

Albite Accounts for Soda Balance

So far the misfitting sodic element has not been taken care of by the crystallizing out of the potassic microcline and orthoclase. But the soda albite now appears, made more aggressively devouring by the fluxing gases, and practically all the remaining sodium is now taken care of. Invasion and replacement of the hardened potassic feldspars now take place, since these, with their higher temperature of fusibility, are still very hot and hence more easily attacked by the gaseous fluxing remainder. We now have a residue, containing a concentration of volatiles, out of which is formed the last of the minerals: the spodumene and the lepidolite. Water must have been an important element at this end, since, of all the pegmatitic minerals here noted, lepidolite gives the most pronounced yield of water in a closed test tube. This was undoubtedly the last to form and solidify, and as observed at Embudo did so in great lenses and masses, occurring, in general, as the central body within the pegmatite. Nowhere does it occur at the outer confines of the body, except in one or two isolated points where erosion of the outer quartz and microcline has exposed it.

There is to be observed in this deposit a second and later distinct generation of quartz. This other type is clear glassy, with no crystal forms or rudiments of



Massive, virtually non-crystalline outcrop of gray lepidolite. Note the suggestion of "flow" structure and the absence of quartz capping

crystallization apparent. There have been no graphic intergrowths and no opacity from the lepidolite or spodumene, although the latter occurs in close proximity to it. This family of silica perhaps was the re-fused quartz at the conclusion of exothermic conditions: the gelatinous silica solidifying in blocks in the presence of high-pressure water gas, and other and obscure factors, and under a condition of reversibility of fusion which has been heretofore stated.

In this pegmatite, in addition to the minerals already mentioned, are to be found others. With the exception of white and pink mica, which in places is to be found in considerable masses, these others can be observed only under the microscope. They are apatite, zircon, beryl, and rutile. No sulphides or ferromagnesian minerals are in evidence.

The northern portion of the pegmatite, heretofore mentioned as the Gray Hill, might be regarded as the thinning edge of the whole pegmatitic lens. Lest a conception of this pegmatite might be formed by which it will appear to be a regular lens-shaped body, it must be stated that it comes far from assuming any such regular shape. It has tongues and irregular wings, many of which originate from erosional inroads. In speaking of it as lens-like, I do so only because, in its larger aspect, it has a thinning out toward its confines, especially toward the north, east, and west, and more gradual in the less-defined, downward, pitching side on the south.

Variation in Texture and Composition

This northern portion takes on a texture, a structure, and a chemical composition significantly different from the south or thicker part of the body. It will be noted from the table of analyses that the gray lepidolite is higher in silica (62.96 per cent) and lower both in potash and lithia and fluorine. In general, this gray lepidolite is massive and non-crystalline or very finely crystalline, showing, as a rule, a banded flow structure. It is as soft as the pink lepidolite on the south hill. Albite is absent. In this area the definition between the schist and pegmatite is less marked; indeed, in places they merge from one into the other, and the pegmatite proper even takes on a schistose character. Certainly, here is convincing evidence that this pegmatite is not to be regarded as having ever been a migrating, invading body. This fact can be regarded as throwing some positive light on the genesis of this body.

Geologic Characteristics of Formation

The area under discussion being on the thinning edge, conditions were naturally not favorable to invasion and inter-migration from other parts of the pegmatite which are thicker and were more conducive to such intermovements. Here also is to be noted less evidence of attack and replacement of the potassic feldspars by albite and lepidolite, and less evidence that exothermic conditions prevailed. Assuming the non-migratory character of the whole, this section must have solidified at a period contemporary, or more nearly so, to that of the mother magma. All action and change must here have ceased while such were still going on in the thicker portions of the pegmatitic body.

The theories here set forth have been adhered to in prospecting for new commercial lenses of lepidolite ore; and this work has met with unqualified success. Nowhere but in the thicker central axis has the type of lilac lepidolite, high in potash, lithia, and fluorine, been found. The thinning edges of the pegmatite predominate in quartz and alkali feldspars, with only in spots a poor commercial grade of lepidolite. Thus is the theory seemingly supported by the actual practice. I recognize the fact that the successful and practical application of a theory in one instance does not prove it to be sound in all analogous conditions of general application. Though these deductions are in accord with the views of some geologists, and not with others, the phenomena, as observed in this field, do harmonize with the theory of the natural history of this particular pegmatite. If the deductions here recorded are logical and reasonable, then the general theory that I have advanced may have some application to other pegmatites which it has not been my privilege to study.

Utah Copper to Try Oil-Electric Locomotive at Bingham

The oil-electric locomotive, the latest development in American railroading practice, has recently made its appearance in the metal mining field. Announcement has been made by the Ingersoll-Rand Co., joint producer, with the American Locomotive and General Electric companies, of the oil-electric locomotive, that one of the 60-ton type was ordered recently by the Utah Copper Co. for use at its mines at Bingham, Utah. The début of the oil-electric locomotive at the Utah Copper mines will mark its first invasion in mining operations anywhere in the world.

In making this announcement representatives of the manufacturers stated that the locomotive is being installed purely in the interest of economy of operation. Engineers of the producing companies estimate that the oil-electric will save 4c. on every ton of ore and waste rock hauled.

The Utah Copper Co. owns 57 steam locomotives, which haul over 30,000,000 tons of material each year. Based upon an average of 526,315 tons per locomotive per year, the saving effected by the oil-electric, at 4c. a ton, would run to $21,052.60 on its year's work. If oil-electric were substituted for the entire 57 steam locomotives, the saving on the 30,000,000 tons of haulage would be over $1,200,000 a year, the manufacturers' estimate.

The oil-electric will take its place with the steam locomotives, or "saddle-backs," in working along the winding switchback roads that girdle the mountain, hauling cars up and down, and switching the loaded ones to side tracks, ready for the process of separating the mineral from the waste. Exactly the same work will be done by the oil-electric and steam locomotives. The only difference will be in the relative cost of operation as between the two types.

Oil-electric locomotives are in use on four railroad systems in the East, and other systems in the East and West have placed orders for them. The Chicago & Northwestern Railroad has just installed one. Aside from the saving in fuel, through the use of oil of heavy grade, the oil-electric locomotive makes further economy possible through the elimination of round-houses, turntables, water-towers and troughs, hostling service, and the handling of coal and ash pits, all of which have the effect of materially increasing the steam locomotive's cost of maintenance.

Modernizing Tin Concentration Practice in Bolivia

Antiquated Machinery, Operated in the Dark, Giving Way to Up-to-Date Types Developed Elsewhere —Local Research to Solve Particular Problems—Complex Ores So Far a Stumbling Block

By Robert D. Ferron
Consulting Mining Engineer, La Paz, Bolivia

Robert D. Ferron

THE last few years have seen a rather marked change in the practice of tin concentration in Bolivia. Mills erected recently show much improvement over the older ones, both in costs of operation and recoveries secured. The purpose of these notes is to describe, in a general way, the more important improvements in practice. Bolivian tin ores, from the standpoint of local metallurgy, may be roughly divided into two classes, as follows:

1. *Simple Ores*—A high percentage of the tin occurs as cassiterite, with iron minerals as the only other important constituent of high specific gravity. These ores may be either oxide, sulphide, or mixed.

2. *Complex Ores*—The tin may occur as cassiterite or in various sulphide forms, associated with important amounts of other heavy base-metal minerals, such as those of lead, zinc, copper, bismuth, or tungsten. These ores also may be oxide, sulphide, or mixed.

By far the greater number of the important tin mines of Bolivia fall under Class 1. This class also contains most of the tin-silver mines of note, the only difference in the metallurgy in this case being that a chloridizing roast with a leach to extract the silver is the first step in the treatment, followed by the concentration of the tin from the leached tailing in the usual manner. Only recently have the complex Class 2 ores received much serious attention. Last year, a commercial plant attempted to treat ores of this class, but with little success; and the new ideas that are being advanced on the subject are still in the laboratory stage. Hence the following discussion of actual practice is confined to the treatment of the simpler type of ores. Ores containing small percentages of bismuth are considered as simple ores.

Gravity Concentration Is General

The concentration of tin now depends basically on gravity methods, as cassiterite, the common oxide, has not yet been floated on a working scale. The concentrate, or "barilla," as it is termed locally, is sold on schedules based on a 60 per cent tin content, with premiums for higher- and penalties for lower-grade products. Since it is difficult to sell barilla assaying under 60 per cent tin, the mills all try to concentrate to at least this figure. At 60 per cent tin, over 75 per cent of the barilla by weight must be cassiterite. For this reason, the plan of gravity concentration employed must be designed to produce a very clean concentrate.

Simple oxidized ores are treated by straight gravity concentration methods, the relatively high specific gravity of cassiterite favoring a satisfactory concentration under good operating conditions. When pyrite is present in any amount, the process becomes more complicated. The older plan, in this case, is to concentrate rather cleanly as to gangue minerals, but allowing much of the pyrite to concentrate with the cassiterite. The low-grade concentrate is then dried, roasted till the pyrite is converted to iron oxides while the cassiterite remains unaffected, and then sent to a re-treatment plant for further gravity concentration to a clean barilla. This plan of treatment sometimes includes the kiln-roasting of the coarse sulphide ore before the original concentration, and sometimes also the final recleaning of the barilla in magnetic separators to remove magnetic iron ores or particles. This older method of treatment has in some cases been modified during the last few years by the application of the flotation process to reclean the low-grade barilla produced by the original gravity concentration, by floating off the pyrite and other sulphides. In a few instances, where the roasting and flotation processes have been thoroughly tried out, roasting has been retained as producing better results. Usually, however, flotation has either replaced roasting, or the two processes are used to supplement each other. Several of the latest mills omit roasting entirely.

Flotation has been applied in two ways: In one, known as the Malmros process, the concentrate of cassiterite and sulphides is treated in batches in a single cell resembling the Minerals Separation machine. Flotation is continued till no more sulphides come off, when the cell is shut down and the cleaned tin barilla discharged from the bottom. The other scheme employs any standard flotation machine receiving a continuous feed of the "dirty" concentrate, overflowing sulphide float, and discharging cleaned tin barilla; both products being either finished or sent to additional machines for re-treatment.

When ores contain a small amount of bismuth minerals, these also largely concentrate with the tin on the gravity machines. The older practice was to roast the barilla, with or without salt, and leach out the bismuth with hydrochloric acid or acid-brine solutions. Some leaching method would probably still be employed when the recovery of bismuth is considered important. At present, owing to the limited market for bismuth, its elimination from the tin barilla is usually desired rather than its recovery in a salable product; hence bismuth sulphides are now often floated from the cassiterite along with the pyrite, and the sulphides stored.

In the gravity concentration, stage crushing is usually employed, with concentration by jig or table between stages. To recover the tin in as coarse a size and as early in the process as possible is considered good practice. More and more attention is being given to careful sizing and classification ahead of the jigs and tables. Operators are beginning to realize the importance of making a clean sand-slime separation, so that these products can be treated on separate machines. Some of the newer mills make this separation quite effectively. As in all gravity concentration, slime treatment presents the most difficult problem. The best practice at present is to make as little slime as possible, separate it sharply from the sand, and treat it separately in as long a series of machines as is practicable.

Heavier Machinery Now Used

Only a few years ago the average Bolivian tin concentrator was likely to be housed in a low, gloomy building with inadequate lighting facilities. Dirty, sloppy floors and overcrowded machinery were commonly seen. Many of these old mills still survive, but those erected within the last few years are mainly well lighted, the machinery is adequately spaced, the floors are of concrete or wood sloped so as to be washed down with a hose, and the launders placed out of the way. Operators are learning that a clean, orderly mill brings increased financial returns owing both to the elimination of direct losses of ores and concentrates, and to the general psychological effect on the mill crews. Much of this progress has resulted from the recent entrance into the tin-mining field of companies experienced in modern copper, lead, and zinc concentration.

The operation of crushing and grinding equipment in general has been improved by providing solid, strong foundations. Concrete work is fast replacing the old masonry bases. Because of difficulties in transportation, crushers and rolls of light construction were formerly employed, occasioning constant repair troubles later. Today, the tendency is to use heavy machinery, often difficult and costly to get in originally, but capable of long, steady operation when once installed.

In grinding mills, the peripheral-discharge ball mills such as the Krupp began giving way several years ago to the more modern, end-discharge ball mills. More recently the rod mill seems to be becoming more popular than the ball mill, owing to its ability to produce a more granular product, with less slime. Grinding mills are usually run in open circuit, so as to produce a minimum of slime, although this means a sacrifice in capacity.

Shaking or vibrating screens are often used when running rolls in dry closed circuit, but have not been very successful in handling wet feed. For handling wet material, such as the coarser sizing ahead of jigs, series of trommels are still generally employed. The fines passing the trommel of smallest opening, and the discharges of grinding mills regrinding the coarser material, are usually sent to drag-type classifiers, of which the Dorr bowl type seems to be one of the most efficient. Classifier sand discharge usually passes to a series of hydraulic classifiers ahead of the tables. The Deister cone baffle classifier is much used for this work. Drag-classifier slime overflow, according to latest practice, is sent to small Dorr thickeners. These overflow true slime to a larger thickener for dewatering, and discharge a fine sand, which is sent to special tables. The fine-sand discharge is sometimes further freed from slime by attaching a hydraulic classifier to the bottom discharge of the small Dorr thickener.

Tables and Jigs for Concentration of Coarse Pulp

Concentration of the coarser material is normally accomplished in Harz and Hancock jigs, the former being usually used where a clean concentrate is desired. The large capacity of the latter has brought them into use as roughers; for instance in re-treating tailings from a series of Harz jigs, turning out a low-grade concentrate for regrinding, and tailing to waste.

Numerous makes of tables, such as the Card, James, Humboldt, Deister, Wilfley, and Deister-Overstrom, are giving good service. Probably the more popular, in general, are the James and Deister Plat-O types. The old practice was often to include many makes of tables in one mill. A better understanding of the advantages of standardization has caused the newer mills to install one make only, except for experimental purposes. Butchart riffling, with large tonnages per table, is now being tried out for rougher work. The old, cumbersome type of slime table has given way to the smaller, modern slimer.

So far as I know, vanners have never been much used in tin concentration in Bolivia, although their use is popular in Cornwall, for the treatment of sand as well as slime, and would seem to be well justified there. After passing the slime tables, a further cleaning of the slime is sometimes done on canvas tables or frames, usually of the multi-deck, automatic tipping type. Then the fines continue on to the buddles. These used to be largely of small diameter, lined with masonry, and swept by hand. More recently, the 18-ft. convex buddle, built of concrete and equipped with mechanical sweepers, has been employed. The buddles are usually built outside the mill building, in series. They require much space and a great amount of hand labor, and their defects are obvious; but no continuous mechanical device has as yet been able to replace them. Revolving round tables are seldom seen in Bolivia.

Many of the standard flotation machines are employed for the cleaning of pyritic concentrates, and all seem to do good work. The Malmros single cell has already been mentioned. Where roasting is used, the old hand-rabbled reverberatory has been largely replaced by multiple-hearth furnaces such as the Kauffmann, Herreschoff, and others, usually oil-fired. Various styles of magnetic separators are used in the final cleaning. Many mills use keeves, either hand-operated or mechanical, for bringing low-grade barilla up to a shipping-grade product.

Driers a Modern Improvement

The older mills often dried the cleaned barilla on stone-flagged floors in the open air, raking by hand. Sometimes the barilla, after settling, was dried on crude drying furnaces, heated by local fuels, and raked by hand. In a few of the latest concentrators one now sees Dorr thickeners, Oliver filters, and Lowden or Ruggles-Coles mechanical driers. The driers are often heated by crude oil, and this mechanical process has proved very efficient.

The basis of the recent progress in Bolivian tin concentration has been the collection and intelligent interpretation of complete mill data. Good housing, bet-

ter machinery, and new processes are often expensive to install, and are usually adopted only after mill operating data have proved their economic advantage. No machine or process can produce its best results unless intelligently operated, and intelligent operation requires complete daily tonnage and sampling data, besides periodical labor, material, and cost figures.

Many concentrators have been run in Bolivia with no other data than weights of ore from the mine estimated by counting the number of cars of ore arriving, a grab sample of coarse ore assayed weekly or monthly for the head sample, a fairly good quartered sample of the barilla produced assayed weekly or monthly, and an incomplete sample or no sample at all of the tailing. Some mills did somewhat better in this regard, but none of them, up to a few years ago, made even a close approach to the securing of complete and reliable milling data.

In some of the newer mills, this term including older mills that have been reconstructed, ore cars or tram buckets are weighed on scales as they arrive, and this weight is sometimes checked on automatic conveyor scales. Good head samples are obtained using Vezin, Galigher, or other automatic samplers, with regrinding when required. The various components that go to make up the sand and slime tailings are often sampled separately, and then the whole tailing together. Individual machine performance is studied and checked up by special samples. Daily assays on all products and screen tests with assays on the tailing are made. These daily data are supplemented by detailed material consumption, labor, and cost figures.

Grab Samples Afford Useful Data But Cannot Equal Chemical Assay

Much reliance used to be placed on the occasional vanning of various grab samples. An experienced man can often judge fairly well as to the work that a machine is doing at the moment by vanning samples of heads and products. Such data are often useful, but cannot replace the record of the chemical assay of daily twenty-four-hour samples.

With the gathering of complete mill data, research work has naturally followed. Ball and rod mills have been run against each other, side by side, and various makes and types of tables have been tested under parallel conditions. The slime-treatment problem is being investigated by experiments in the use of rectangular frames and other devices that have been developed in Cornwall. All machinery in general is now being subjected to actual tests instead of being appraised by the eye, with a great increase in accurate knowledge of operation.

The change from the old haphazard style of operation to modern, scientific concentration methods in some of the mills has resulted in the following improvements in operation:

1. An increased recovery of the tin. Whereas 70 per cent recovery used to be considered good work, and many mill recoveries dropped as low as 50 per cent, today some mills treating pyritic ore make 85 per cent recovery.

2. Better machinery and better mill construction have resulted in lower repair cost, and much less loss of time required for repairs. The latter is a factor that often was not formerly given its due importance.

3. Better arrangement of machines and the increased use of labor-saving machinery have greatly cut down labor cost. Tons treated per man-day have been increased to as much as three times the older averages.

Opportunities for Future Progress

Simple Ores—In most Bolivian mills coarse jig and table tailings are now discarded when they assay below the average value of the total tailing. It is probable that in many cases the recovery could be raised with favorable economic returns by regrinding these tailings and reconcentrating the sand portion of the ground product. This is simply applying to tin concentration the present tendency in other base-metal concentration practices.

Aside from this, slime treatment seems to offer the best field for research, since the biggest losses are at present in the slime. If a flotation process could be devised to float efficiently fine cassiterite, great economies might be made in tin concentration, especially if the tin could be floated preferentially from pyrite and other sulphides. Lacking this, some continuous mechanical device to take over the work now being generally done by the buddles might be introduced to advantage—possibly vanners or mechanical round tables or frames.

Complex Ores—The complex ores present another field for investigation. Few or no seriously complex ores are now being treated in Bolivia on a commercial scale, although many orebodies are known to exist. Some of these ores contain part of their tin in various complex sulphide forms, which complicates the treatment problem further.

Roasting and leaching processes for the removal of the other base metals, leaving the tin in a condition to be concentrated by gravity methods, seem to present favorable possibilities, even though a few plants operating according to this plan have not been successful. One plant included flotation removal of sulphides along with leaching. The need is for more careful laboratory work, careful testing under actual working conditions, of processes found favorable in experimental plants, and finally the building of good treatment plants after the process adopted has been thoroughly demonstrated; all this under conscientious and intelligent direction. Research work of this kind is costly and requires well-trained direction. Good results may be expected only when the stronger companies in the field become interested in this work.

Another promising line of research is the reduction process. Many advances have been made in copper-ore treatment, as for instance at Bwana M'Kubwa. Interesting experimental work has been done both in Bolivia and in the States, on tin ores. After reduction to the metallic state by contact with reducing gases under special conditions, the tin may be either leached out or removed by concentration methods. The dielectric separation process, which is being developed by Dr. Hatfield in England, also offers possibilities for future developments of importance.

With the present high prices for tin, and the favorable future prospects, progress in the metallurgy of tin in Bolivia should continue to make steady and important advances, particularly if a scientific and forward-looking attitude toward metallurgical problems becomes generally adopted.

Some Adverse Influences of Glaciation on Mining*

Ore Deposits Often Eroded—Others Deeply Buried and Rendered Unavailable—Complication of Geological Studies

By Virgil R. D. Kirkham
Geologist, Idaho Bureau of Mines and Geology, Moscow, Idaho

AS A RESULT of considerable geological field study in the area shown in Fig. 1, I became impressed with certain adverse effects of glaciation on mining which seemed to be consistent and widespread throughout the glaciated area. The literature of both glaciation and mining appears to be notably barren of references to the influence of the former upon the latter. I feel convinced that this relationship must have been noted by other geologists and engineers, and the observations herein are not intended as a pretentious or exhaustive discussion on the subject, but rather as stimuli or suggestions for elaboration to those who have not expressed themselves on the matter and likewise to those who have never considered it.

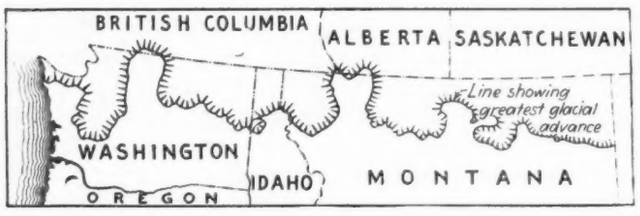


Fig. 1—Sketch map of Pacific Northwest, showing probable farthest south advance of continental glaciation.

Present-day glaciers in the temperate zones are of the valley, alpine, or cliff types, and are found only in the high Sierras, Cascades, and northern Cordillera. These glaciers have many characteristics similar to those of streams, inasmuch as they are located in valleys, and flow down hill. A flow measurable, but imperceptible, transports the ice from the head to the foot of the glacier. The ice likewise erodes material from its walls and bed and carries its load from one place to another. The flow is more rapid in the center, and may be several hundred feet per year, but will vary with conditions.

In the northern latitudes of the United States, glaciers exist as low as about 5,000 ft. before the melting equals the flow. Many of them have sources above 11,000 ft. in height. Their length may be from a fraction of a mile to several miles. A width of two miles is not uncommon and thicknesses will vary from place to place. Such glaciers alter the valleys through which they move by broadening and deepening, and by lengthening them through headward erosion. The resultant material, called moraine or drift, is carried on the surface or in the body of the ice to the glacier's nose, where it is deposited as the ice melts. Types of moraine from these glaciers are known as lateral, medial, ground, and terminal, taking their names from the place of accretion or deposition. Vast changes, both by erosion and deposition, are accomplished by these slowly moving ice masses where they have operated over a long period of time.

Glaciation is known to have existed as early as the Permian Age[1], possibly twenty million years ago. At that time a continental ice cap is thought to have extended over much of Canada and the northern United States. Most of the high mountain masses of that period were perhaps occupied by alpine, valley, and piedmont glaciers. Crustal and erosional changes in the long-ensuing period have, however, practically obliterated most of the influence on our present surface. Ice invasions within the last 200,000 years have, to the contrary, been highly instrumental in molding our present-day terrane.

Four continental ice sheets are believed to have swept down from Canada and invaded the northern United States. The periods of maximum extent for the last three may, for convenience, be estimated roughly as 25,000 years apart. The last one is perhaps only 15,000 years distant. Each ice sheet effected notable changes in topography and drainage. The purpose of this paper is to attempt a brief analysis or description of the consequent effect and influence of glaciation on the mineral industry.

Glaciation and Placer Deposits

Glaciation generally affects placer deposits disadvantageously, as shown in the following cases:

1. A familiar illustration, Fig. 2, is afforded by gold veins cut by ordinary stream erosion, so that the free gold, disseminated at first, is later concentrated into commercially workable placer deposits, similar to those which have resulted in the many Western gold rushes. With such conditions, an invading glacier shears off valley walls, gouges out rich valley bottoms, and eventually deposits the load, with the included gold, in a mass infinitely more disseminated and inaccessible from recovery than in its original deposition. Many localities in British Columbia, northern Idaho, Montana, and Washington have had this history. This disseminated gold, which shows in every pan and ever fails to run richly, is a Lorelei of disappointment to hundreds of prospectors.

2. Another illustration, Fig. 3, is where the gold-bearing gravels are not greatly disturbed by the glacier, but the glaciers, or the floods from their melting, have buried rich deposits beneath morainal overburden so deep that their discovery is impossible, except when accidently revealed by subsequent erosion. Even then the average prospector will justly refuse to suspect the unassorted and boulder-strewn glacial drift of containing workable values. Several discoveries of the existing placers in British Columbia have resulted from recognition of old valley bottoms in the process of being disrobed of their glacial mantle.

*Address delivered before the Northwest Mining Convention, Dec. 1925, Spokane, Wash.

[1]Many geologists believe evidence points to glaciation in Pre-Paleozoic time.

Note: Date for northwestern Washington derived from Bull. 18, Washington Geological Survey; for northeastern Washington *Jour. of Geol.*, Vol. 31, No. 8, 1923, for central and eastern Montana, Montana Bureau of Mines and Metallurgy, 1921. Data for other areas are compilation by writer.

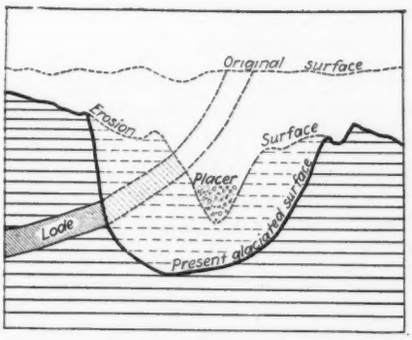


Fig. 2—Section showing erosion of vein and development of placer. Subsequently valley glaciation has removed rich placer and also more vein.

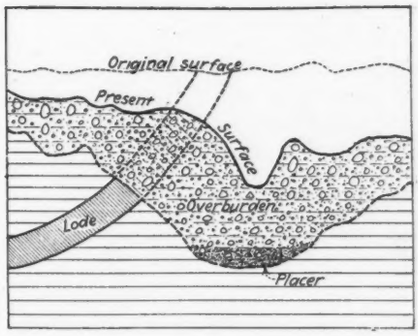


Fig. 3—Section showing erosion of vein and development of placer. Subsequent glaciation has entirely concealed placer and vein.

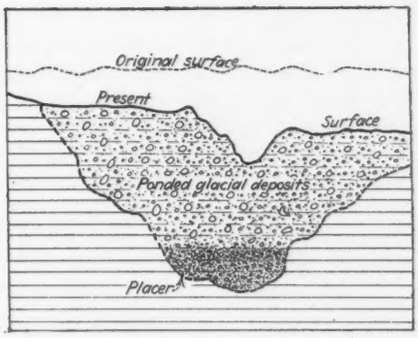


Fig. 4—Section showing placer deposits underlying glacial deposits. Mining this placer is unprofitable because of excess of overburden.

3. A third case is that where placer deposits, Fig. 4, in old stream beds have also been relatively undisturbed, but have been covered by great thicknesses of quasi-stratified and poorly assorted materials that have resulted through morainal damming of the main valley by tributary glaciers at a point down the valley from the placer. This condition may be revealed at one end of the ponding, but the thickness of overburden is often so great as to prevent either dredging or hydraulicking in a commercial way. Instances exactly like this exist in several northwestern districts. A disadvantage is also met in the drilling of test holes for values in cases where a mantle of glacial detritus overlies a known or suspected rich bedrock deposit.

Everyone recognizes, of course, the difficulties encountered in attempting to drill through huge boulders of every shape and degree of hardness, as well as the uncertainty of determining bedrock when it is reached.

4. After a long lapse of time much of the harm may be partly rectified by ordinary stream action in the glaciated valley. In many instances, a secondary concentration of the gold may be effected by the running water, although perhaps never so successfully as in the original concentration from the vein or lode, because of greater dissemination and greater comminution in the morainal mass. Such reconcentrations, however, may again be nullified by a second ice invasion no less disastrous than the first. Many valleys in the northern Cordillera and Cascades have undergone several of these ice invasions and their consequent interglacial epochs, wherein, it is probable, the water has tried fruitlessly to reconcentrate the values, with a leaner feed upon which to work in each succeeding effort. Considering the hammering, gouging, moving, and pressure received by the malleable yellow metal in its journey down the valley with these ice invasions, can we wonder that the nuggets are so small and flat that we call them "oatmeal gold"?

Glaciation and Its Effect on Lode Deposits

Glacial effects on lode deposits appear to have been no less devastating than on placers, but they are more easily discernible, as shown in the following examples:

1. Let us take the usual case of ordinary stream erosion exposing ore-bearing ledges in the valley walls or on near-by summits, Figs. 2 and 5, and watch the entrance of glaciers of the valley or even the continental type. The former may deepen and widen the valley and thus decapitate or even decimate mineral veins. The continental glacier, overriding whole mountain ranges, may remove hundreds or even thousands of feet over vast areas. The effect of such encroachments is often revealed to us in the remaining comparatively worthless roots of veins, Fig. 6, with shallow oreshoots, and in the scattering of original minable ore in the form of rich float over an area perhaps thousands of times as great as that occupied by the original vein. Ore deposits exist, in the Northwest, exposed on mountain crests where evidence makes it certain that as much as 1,500 ft. of the mountain mass has been removed by continental ice sheets. The lengths of the veins and their shallowness offer persuasive evidence that the upper portions have been mined by the ice. In cases where a set of parallel veins, of similar length and mineral content, are so arranged that valley glaciers have removed successively greater portions from the

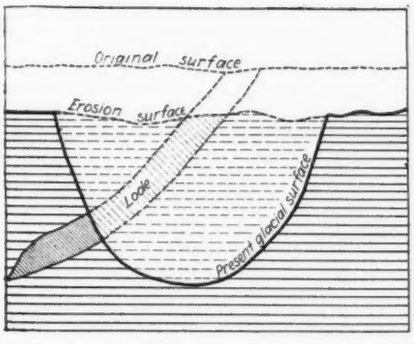


Fig. 5—Section showing erosion by valley glacier which has removed all but the lower portion of vein, leaving but little to be mined.

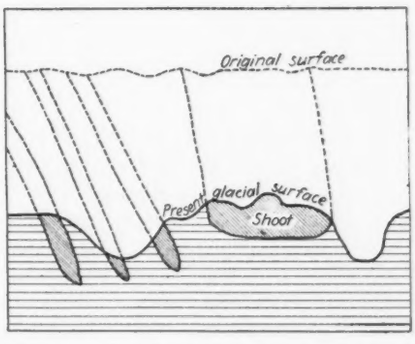


Fig. 6—Erosion of veins and shoots by overriding continental glaciers. Depths inconsistent with lengths may perhaps be thus explained.

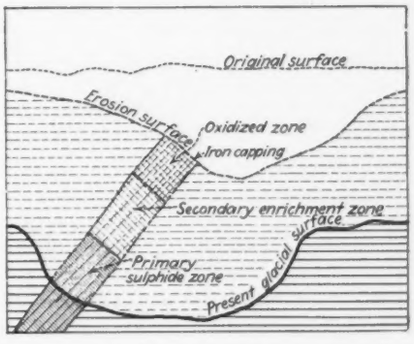


Fig. 7—Section showing removal of iron capping, oxidized zone, secondary-enrichment zone and part of the primary sulphide zone by glaciation.

veins as they lie nearer the center of the valley, it might even be possible to approximate the amount of ore lost.

2. A deleterious effect on prospecting for veins is the removal, by the glacier, of oxidized zones and iron cappings, Fig. 7, so easily recognized and likely to accompany the normal mineral vein in an unglaciated area. The time which has elapsed since the scalping by the glaciers has generally not been sufficient to permit any notable oxidation, and these veins, where found, exhibit bright and untarnished sulphides.

3. Likewise, this truncation by the ice has in many places removed the comparatively rich zone of secondary enrichment, Fig. 7, which has been the source of dividends by some mines from otherwise ordinary or mediocre orebodies. If unaltered sulphides appear at the outcrop, it would be futile to expect a zone of secondary enrichment.

4. Another result of ice erosion perhaps worthy of mention is the tendency for the vein to be more easily eroded than the more compact and more homogeneous surrounding country rocks, so that outcrops are likely to comprise places where the vein pinches, Fig. 8, and is lean, or almost entirely unmineralized, and where the

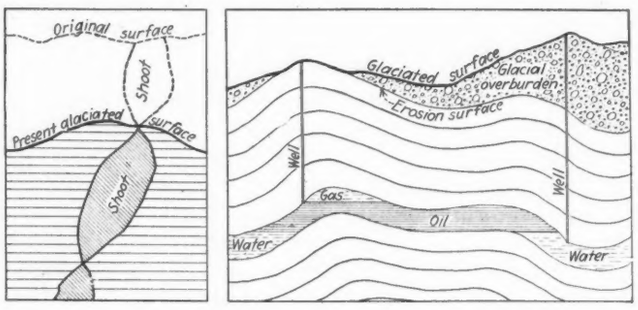


Fig. 8—Section showing greater resistance of vein where it is pinched and wall rocks are close together. Fig. 9—Section illustrating uncertainty of drilling on structures wholly or partly masked by glacial drift. Topographic high points may be structural high points or drift high points.

walls are close together. The disadvantageous result of glaciation presents itself here by exposing the vein in its most unattractive form. Although rich shoots may have been eroded, others may lie immediately under this outcrop, which may be so meager as to discourage exploration.

5. The results accruing from the depositional action, Fig. 3, of glaciers are equally inhibiting. Many commercially mineralized ore deposits are concealed beneath the widespread blanket of drift which covers valley bottoms, plateau, and plain-like erosion surfaces. Now and then stream erosion or landslides dislodge drift and expose hidden veins in areas prospected for years. Incidentally, this may suggest a reason for some of the numberless lost mines of which we hear so much. If a landslide can expose a vein, it or another might with equal facility conceal one.

6. Many other disadvantages of minor importance can be attributed to glaciation. Among those may be mentioned the additional cost and difficulties of drifting through wet, unconsolidated glacial drift, or the inaccessibility of mines or prospects situated at heads of swamp-filled glaciated valleys which prohibits or discourages commercial exploitation of properties. Many areas in the Buffalo Hump and Selkirk regions are thus handicapped.

Glacial Deposits Interfere With Petrolium Prospecting

The prospector for ores and the miner is no more handicapped by the takings or leavings of glaciers than is the prospector for petroleum. The modern prospector for petroleum depends upon the recognition of numerous geologic factors which must be present before an area can be labelled as favorable for oil production. Among these things are many which can be concealed by a glacial overburden.

1. Since it is necessary to know the age of the beds, fossils must be found and examined. Where outcrops are few and far between, such a search may not meet with success if the fossils are not abundant and are scattered throughout the entire formation.

2. Structures which are essential for trapping and concentrating oil in commercial quantities may be entirely concealed or so indistinctly revealed as to prevent exploratory drilling. In areas where structural domes are likewise topographic eminences, and glacial drift is unequally scattered over the area, great confusion arises, especially where some domes are partly uncovered. This causes drilling in areas which are topographically high, Fig. 9, due only to piled-up moraine.

3. In a structure even partly masked by glacial débris, closure cannot ever be certainly determined before drilling. Since this is one of the vital requisites for a structure, it is easy to see the great harm that glacial deposition can exert in developing new oil pools. Areas such as these exist in Montana and Western Canada, and include productive as well as untested fields.

Coal, clay, phosphate, and other non-metallic bedded or blanket deposits are often unfavorably effected by glacial action, as shown in Fig. 10. These deposits are as likely to be concealed by drift as are placer and lode deposits and oil structures. Where the deposits are flat they can be entirely removed by the scalping, erosive action, or when they are folded they may in a few instances be removed except that part in the lower portion of the synclines. Some coal deposits are thought to have had 95 per cent of their mass eroded. Erosion and landslides have been instrumental in discovering vast workable coal deposits both in Puget Sound and British Columbia within the last few years.

In the case of clay, where water erosion or landslides have exposed its presence in valley walls, many instances occur where the glacial overburden is so great as to prevent stripping and pit mining, and its value is too low to permit underground mining methods, especially where heavy timbering must be installed.

Glacial Drift Renders Geological Studies Difficult

Although many of the instances herein cited are true geological problems, they deal with some type of commercial mineral deposit. It is evident, or course, that all geological work in an area, even though it may seem distant from any known mineral deposit, has its value, since it is now generally conceded that mineral concentrations have fairly definite general relationships to certain geological and structural conditions. It is likewise obvious that the faulting system in a mine may be much better understood and more easily worked out if the general faulting system of the country has been determined. The type, extent, and value of an ore deposit may be more easily ascertained if knowledge of adjacent or remote igneous rock bodies is available.

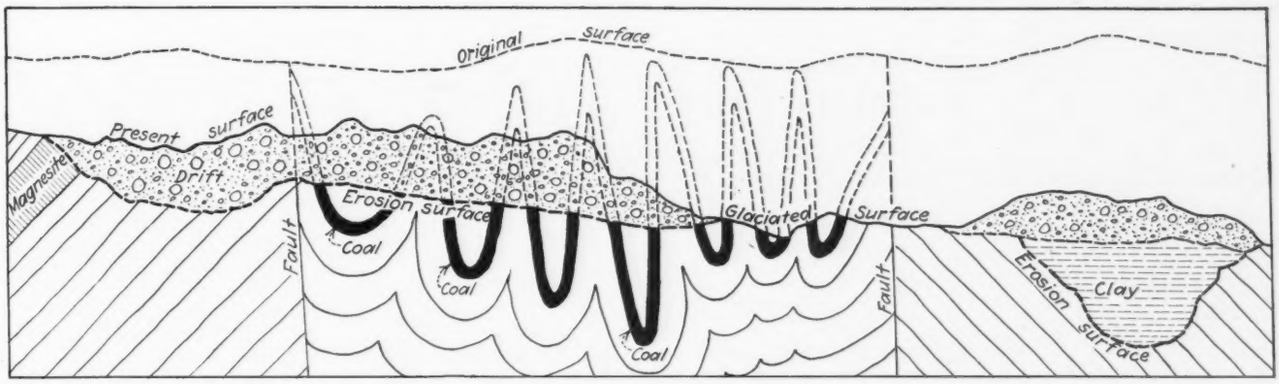


Fig. 10—Idealized and generalized section showing overburden of drift masking magnesite, coal, and clay, preventing either discovery or commercial extraction. An occurrence of glacial erosion of unusually steeply folded coal seams is also shown.

Glacial drift often conceals areal outcrops, age relationships, and structural features, to such an extent, Fig. 10, as to throw geological determination of relationships into the realms of pure speculation.

The leaving of drift by continental glaciers on mountainous areas is a constant source of confusion, for where it is plentiful it is generally difficult to determine what is local and what is foreign to the locality.

Presence of "Float" Is Not Dependable Evidence

In a glaciated country very little dependence can be placed on either ore or rock float, since the specimen may have been transported some distance from its place of origin.

Reference to properties or even districts illustrating these cases has been carefully avoided for reasons obvious to everyone. None of these cases are hypothetical, all have been suggested by the practical conclusions of field observations.

In the light of these observations the mining industry of the glaciated portion of the Northwest, or perhaps any glacial area, would have been notably more successful and productive of mineral wealth but for the ice invasions of the last 200,000 years.

Gold Output of Idaho Decreased in 1925

Idaho's production of gold in 1925 was 20,108.41 oz., valued at $415,640.82, a decrease of 6,128.80 oz. and $26,682.30 as compared with 1924, according to the annual report of the State Mine Inspector, Stewart Campbell. This decrease brings the total down to the lowest point ever reached in the history of the state, and serves to emphasize the lethargy in gold mining. The decline is not due to an exhaustion of the gold resources, as there are many excellent opportunities for profitable gold-mining operations, both quartz and dredging, to be found in the state, according to Mr. Campbell.

Continuous operation of the dredges of the South Park Dredging Co. and the Yukon Gold Co., at Featherville and Murray, was responsible for the larger part of the gold produced. The other large producers of gold in 1925 were: the Idaho Metals Co., at Mackay; the Unity Gold Mines Co., Warren; the Gold Hill & Iowa mine, at Quartzburg; Talache Mines, Inc., at Talache, in Bonner County; and the Boise Placer Co., situated at Idaho City.

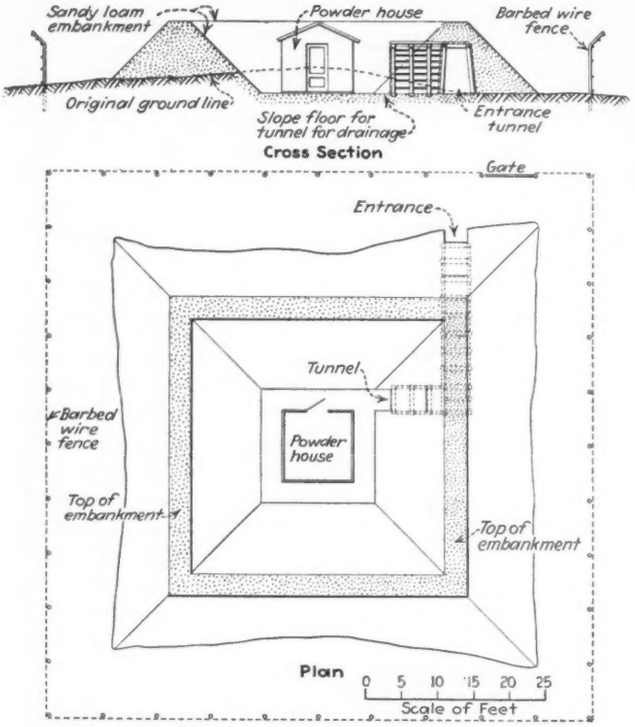
The Difference Between Price and Value

Most investigations into price-level changes, says *The Statist*, especially changes such as have occurred since prewar times, show the factor of volume of money in circulation to have a preponderating influence. Many, however, appear to find great difficulty in accepting this conclusion. As a typical example we may quote from a paper prepared as recently as 1921 by a prominent American banker and an eminent economist in which the causes of the rise in American prices in 1919 and early 1920 were stated categorically as follows: "(a) The insatiable demand of Europe for goods in this country without limit of price or quantity; (b) the continued gigantic expenditure on the part of the American government; (c) the wave of extravagance which spread over the American people; and (d) declining industrial efficiency, with the further shortening of supplies in the United States.

To reason on such lines, *The Statist* goes on to say, is to take a Ptolemaic view of the world of economics. Before Copernicus, it did not occur to anybody that the apparent movement in the stars from east to west was really a movement of the earth from west to east. The above quotation illustrates a similar inversion of perspective; it assumes that the value of all commodities was rising, when in reality it was the value of the monetary unit that was falling.

This distinction between price and value should be obvious to all, yet it is very commonly overlooked. It should be clear that if the price of copper, for instance, rises by 10 per cent over a given period, and the prices of other commodities rise simultaneously by 15 per cent on the average, the value of copper has fallen. Yet analyses of the conditions of supply and demand as regards a particular commodity are made every day, drawing conclusions as regards price that refer really to value. Movements in value are not synonymous with movements in price; it is only deviations in the movement of the price of a particular commodity from the movement in the general price-level that denote changes in its value. Consequently, every analysis of the price outlook for a particular commodity should take into account the outlook as regards the general price level—that is to say, movements in the purchasing power of money. In fact, it does happen very frequently that during a period when a particular commodity falls in price the conditions of supply and demand affecting it are strongly in favor of a rise in its value.

Useful Operating Ideas



Plan and elevation of explosives magazine, Franklin, N. J.

Explosives Magazine Construction for Maximum Safety

By R. M. Catlin
Franklin, N. J.

With the development and increasing use of high explosives, new storage problems were encountered. In the earlier stages of the introduction of these explosives spontaneous decomposition caused many disasters and created an impression that explosions must be expected where the new explosives were stored for any considerable period. In time improvements in manufacture gradually reduced the danger to its present point of comparative safety. Probably there will always be the possibility of great disaster where large quantities of high explosives are stored, so that it seems highly desirable so to construct magazines as to minimize the effects of any explosion, though the probability of such explosion be even more remote than it is now.

To this end it would seem advisable to locate the magazine with the contingency of such explosion in mind. It seems that an ideal location would be the top of a sandy hill, as remote as convenient from a populated area. Formerly some communities had laws requiring that the buildings be made of masonry with walls two or three feet thick to avoid fire risks or the danger from vagrant bullets. Some of us, having declined to build a magazine on such specifications, ultimately succeeded in getting a change in these regulations. Such a magazine even on the top of a sand hill would, in the event of an explosion, furnish missils to bombard the country, and the higher the hill the greater the endangered area would be. It would therefore seem prudent, and in fact a fundamental requirement, that the structure should be made as light as possible. For example, an adobe or a soft unburned brick wall, in the event of an explosion, would probably be reduced to dust and furnish no missiles. And, if on the top of a sand hill in a depression in the sand, the concussion waves would be spent in an upward direction, as those in a lateral direction would be largely minimized and spent in removing embankments.

The accompanying figure illustrates these ideas. The building is placed in the excavation so that no part of it is visible from outside of the inclosure, and is thus protected from stray or viciously directed bullets, and for this purpose the entrance may either be effected as shown, or by steps over the embankment. The ventilation may be made as complete as desired and a free circulation of air allowed beneath the floor and even through it. The whole area inside the embankment should be perfectly drained. In cold climates the details are varied, and air, heated either by electricity or other means outside of the inclosure, can be used to keep the magazine at the desired temperature.

An Adjustable Drag-Type Classifier

By H. A. Linke
Arthur Plant, Utah Copper Co., Garfield, Utah

In classification operation wherein is used the drag classifier of the Dorr type, the screw classifier of the Akins type, and the Esperanza classifier, a problem is presented which to date does not seem to have been satisfactorily solved.

Owing to variation in the hardness of the ore, it is difficult to maintain a fairly uniform overflow with a minimum percentage of oversize. Where (1) the ore changes from soft to hard and settles readily in the machine, the overflow carries a low percentage of solids and very little oversize; it therefore becomes necessary to reduce the water. Where (2) the classifier feed

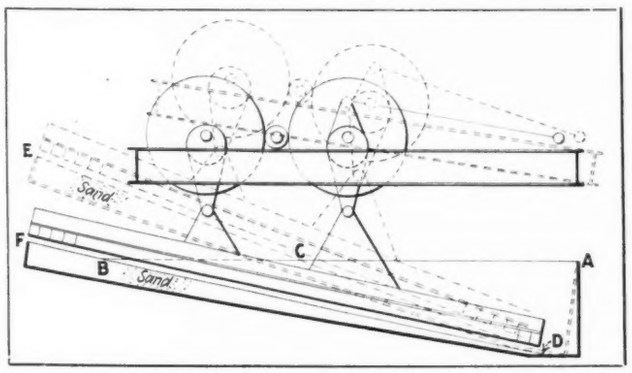


Fig. 1—Adjustment of classifier rakes by tilting raking mechanism

changes also when the tube mill produces an abundance of slime, the feed becomes thick and it is necessary to add more water. The increase in pulp density before addition of water results in a high percentage of oversize remaining suspended in the pulp and being carried off in the overflow.

In example (1), if the effective settling area and volume of the classifier were to be reduced, there would be a consequent reduction of undersize material carried over with the sands. In example (2), if the effective settling area and volume of the classifier were to be enlarged, there would result an increase in settling of oversize material, with reduction in the overflow.

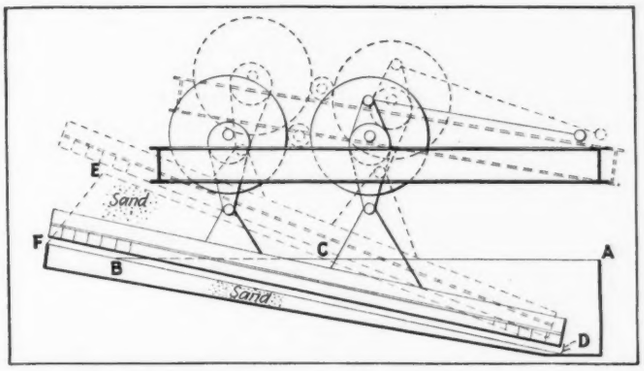


Fig. 2—Adjustment of classifier by tilting classifier about an axis at discharge end

Some effort has been expended in the attempt to reduce at will the settling area of drag classifiers by the use of hinged weirs. This contrivance may reduce or increase the settling area about 10 per cent, but the effect on the volume is relatively insignificant. The hinged weir does not solve the problem, for the reason that the percentage increase or decrease of settling area or volume is insufficient to produce the desired results.

Increase or decrease in the settling area and volume of the classifier can be simply and quickly effected by tilting the whole machine or its mechanism only, on an axis parallel with the weir lip. Fig. 1 shows in solid lines a drag classifier in the low position, which gives maximum settling area and volume for classification of soft ore. The dotted lines show the whole machine tilted upward on an axis through the overflow weir at "A." In this position for operation on hard ore the settling area and volume are reduced to about 60 per cent of that in the first position. Fig. 2 shows the same drag as in the first position of Fig. 1. The dotted lines of Fig. 2 show the mechanism tilted upward on an axis through the weir lip, the pan remaining stationary.

The same results are obtained in both cases. In the second, Fig. 2, with mechanism tilted, the sands form a new bed, and are discharged drier than in the tilted position in Fig. 1. In Fig. 2 less weight is raised than in Fig. 1 and the sand discharge and weir flow remain fixed, thus eliminating practical difficulties in launder construction. It is a matter of choice whether the whole machine or its mechanism alone be adjustable, or where the axis be located. If the axis be through the center of gravity of the machine, or through the center of gravity of the mechanism, as the case may be, the least amount of power will be required to effect the adjustment.

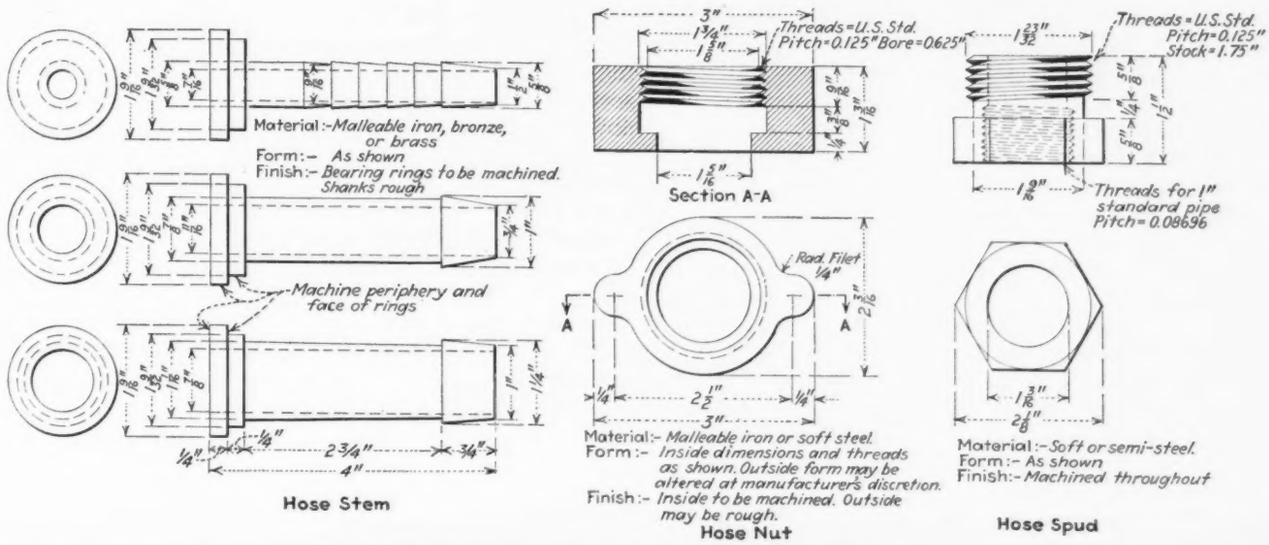
Standard Hose Fittings at the United Verde

By W. P. Goss

Chief Efficiency Engineer, United Verde Copper Co., Jerome, Ariz.

Three sizes of hose are in use at the United Verde property—namely, ½-in., ¾-, and 1-in. The 1-in. hose is used for mounted drills, the ¾-in. hose for stopers and jackhammers, and the ½-in. hose carries water to all types of drills. The accompanying illustrations show how, by the use of three different stems, a standard nut or ring can be used on all sizes of hose to fit a standard spud, this spud being on all types of machines and at the ends of all pipe lines, whether for water or for air. The arrangement allows any size of hose to be used on any drill without changing connections.

Thread on both spud and nut is the standard 1-in. thread adopted by all drill manufacturers for their hose connections. The spud is manufactured by Ingersoll-Rand Co., Denver Rock Drill Manufacturing Co., or Sullivan Machinery Co. The nut or ring has the same dimensions as the standard nut furnished by Denver Rock Drill Manufacturing Co. Stems, nut, and spud can be ordered from any manufacturing concern.


Material:-Malleable iron, bronze, or brass
Form:- As shown
Finish:- Bearing rings to be machined. Shanks rough
Machine periphery and face of rings
Hose Stem
Threads=U.S.Std. Pitch=0.125" Bore=0.625"
Section A-A
Rad. Filet 1/4"
Material:- Malleable iron or soft steel.
Form:- Inside dimensions and threads as shown. Outside form may be altered at manufacturer's discretion.
Finish:- Inside to be machined. Outside may be rough.
Hose Nut
Threads=U.S.Std. Pitch=0.125" Stock=1.75"
Threads for 1" standard pipe Pitch=0.08696
Material:- Soft or semi-steel.
Form:- As shown
Finish:- Machined throughout
Hose Spud

Working drawings of standard hose fittings

Discussion

Problems of the Mineral Industry

THE EDITOR:

Sir—In the extracts you made some weeks ago from "Some Problems of the Mineral Industry," an address by F. H. Probert before the San Francisco meeting of the A.I.M.E., attention was called to the lack of study of surface conditions and their bearing upon the finding of ore deposits, and the subordinate places that such studies hold as compared with the "ultra learned discussions of ore deposits already known to exist." It is in the belief that these ideas are important, and should not be allowed to pass without some comment, which, it is hoped, will throw, perhaps, an unexpected light upon the value of surface studies.

When Mr. Probert makes a distinction between the study of ore deposits as a science and their study as an aid to finding ore, the point is well taken. When the study is pursued strictly from a scientific point of view, its scope may be very wide, and is certain to be extended to much that does not, and never will, have the slightest bearing upon the finding of ore. Thus the so-called economic geology of the day has become littered with a mass of facts and "learned discussion" that mean nothing to the miner. Though no one can be sure of the ultimate value of a newly discovered principle or fact, nevertheless some sort of a limit should be recognized as to what may be considered as geology of a utilitarian character. Scientific geologists may take on as much latitude as they see fit, but in doing so their attitude should be recognized, and the academic character of the work acknowledged; and excellence in such pursuits should not be considered as prima-facie evidence of excellence in the business of finding ore.

In making a plea for the study of surface conditions Mr. Probert points out the road to reform—the way back to the straight and narrow path of utilitarian geology. However, like all straight and narrow paths, it is likely to be a difficult one. In this case, the belief may be ventured that it will be an uncommonly difficult one. This will arise partly from the fact that instructors will be extremely rare, and that it will be necessary to conduct the studies in the field, and for long periods of time.

Mineral districts occur under conditions that must, in their very nature, be out of the ordinary. Commonly, this is reflected in the topography, and the topography sometimes tells a better story than hundreds and thousands of feet of underground workings. Indeed, badly placed workings may "prove" the absence of ore that exists, but nature does not lie so readily. There are significant features in the topography of every district. To detect these it is necessary to gain such a knowledge of surface conditions that any departure from what may be termed "normal" topographical forms will stand out in contrast with the surrounding conditions and invite investigation. A long familiarity with both mineral and non-mineral lands is necessary for the mastery of this trick.

It was in the study of the surface that geology found its beginnings, and it will be by studying the surface that economic geology will get a fresh start. It is a question if a profound change in some geological beliefs is not impending. Igneous rocks, and their sources, the much-studied magmas, now for thirty years or more, since the publication of Posepny's famous paper, have received a vast amount of attention. It would be surprising if the heat, or the critical portion of the heat —that is, the last increment of heat—should be traced to the action of surface agencies, or, to be more paradoxical still, even to the radiated heat of the sun. This sounds a good deal like Hamlet's query: "Why not imagination trace the noble dust of Alexander, till we find it stopping a bung-hole?" But, like Hamlet, it may be said that it may be, "followed thither with modesty enough."

It is now more than twenty years since F. D. Adams, of McGill University, made his highly important experiments upon rock flowage. That experimenter left little doubt that rock under such pressures as prevail at great depths beneath the earth's surface may flow. Undoubtedly, these experiments were prompted by observations upon the surface exposures of schists and gneisses of the Pre-Cambrian shield of Canada. More recently, the development of the theory of isostacy, another outgrowth of the study of surface conditions, when considered in connection with rock flowage, promises to become a factor in both general and economic geology, and even prove to be of importance, through a somewhat similar process, in particular mineral districts. This will come about through heat generated by the flowing rock. Bowie, who seems to be the leading exponent of the isostacy theory, cautiously touches upon the generation of heat in a discussion subsequent to his main paper.

This principle of the generation of heat in connection with mineral districts has recently been considered by myself in a discussion of papers presented at the meeting of the A.I.M.E., held at Salt Lake City, in 1925. It seems certain that as isostacy is better appreciated, and the connection with rock flowage and what appears to be the inevitable generation of heat, there may be a radical change in our ideas of the sources of, at least, a portion of subsurface heat. Isostatic adjustments causing the flowage of rock being due to the shifting of weight through erosion, and erosion, in turn, being dependent upon evaporation and precipitation and changes in temperature, it seems that the paradox of attributing internal terrestrial heat to the sun through it action upon the surface is considerably more plausible than tracing Alexander's dust to a bung-hole.

It is not possible here to discuss the strictly utilitarian phases that the study of surface indications may lead to. After many years' observation of surface conditions, it may be said, however, that much of great practical value is constantly overlooked. Personally, I have gradually developed a systematic method of observation. Certain geological conditions are fre-

quently repeated in different districts. A quick method of survey requiring a compass, a notebook, and, sometimes, at the start, a tape, has been developed. This serves to record significant facts, places them in approximately their correct positions, and, in general, serves to keep important details properly oriented, a matter of great importance. It has been my habit, in the early stages of an investigation, to consider the geological time clock to be set back an hour. This necessitates a mental restoration of the eroded formations immediately above the present surface. When this is done it serves as an aid to visualize what actually occurred, particularly with reference to intrusions, and the very important horizontal faults that usually result from them. By picturing a present surface as from 100 to 1,000 ft. underground, the fact becomes apparent that something must be pushed aside in order that a dike 5 ft., 100 ft. or 500 ft. in width may find room.

Field maps should show the dimensions of intrusive outcrops. In one instance within my experience a faulted vein was thrown over a quarter of a mile. The above method indicated the fault before it was otherwise suspected, and also where to find the continuation of the vein, which, being easily eroded, left no visible outcrop. Circumstances prevented the use of the discovery, and the outcrop was again covered and is probably as it was left. It is not difficult to recall other instances where the use of this principle became of real economic importance.

Other useful guides to the observation of surface evidence might be cited if space permitted. Every district displays a bewildering array of facts. To recognize the significent ones is the difficulty. A long, straight canyon is likely to indicate a fissure—a number of them lying parallel: a series of fissures. In the latter case, there will be a ridge between each fissure. Where these ridges are indented by saddles which "line up," they probably indicate another set of fractures which intersect with the first, a condition that may be of the highest importance in a mineral district, and likely to throw a great deal of light upon the ore deposits.

From what has been said, it will be seen that surface studies are apt to lead to the solution of questions ranging from the academic to the practical. It is essential, however, that if economic geology is to occupy a place of respect in the mind of the practical miner, its academic side must be resolutely kept in the background when geology is brought out into the busy world to be used as a guide in the hunting of ore.

Philadelphia, Pa. CHARLES A. PORTER.

Sulphide Deposition at Joplin

THE EDITOR:

Sir—Having no technical knowledge of geology, I may have no right to intrude an opinion into a discussion of ore deposition. However, observations over a period of thirty-nine years in contact, reportorially and statistically, with the mining of zinc-lead sulphides of southwest Missouri, southeast Kansas, and northeast Oklahoma suggest to me that the final theory of deposition will be sifted from the three hypotheses mentioned editorially in *Engineering and Mining Journal-Press* of June 5.

The one thought I would inject is that of the final precipitation: This has seemed to me to be water of the chemical content of rain water. This theory is based on results of dewatering the old Lehigh, Missouri, mine workings, and of the reconcentration of old mine dumps, which have disclosed pure crystals unblemished by contact with jigs and of a size to raise a doubt that they could be present otherwise than by deposition. Time has proved continuous deposition in the old Lehigh mines, under certain favorable conditions. Re-drainage of these workings has shown deposition that occurred during inundation. For instance, I possessed, and sent to the Chicago World's Fair, a mold of pure blende which had formed over the square point of a pick, the steel having corroded. I have seen similar molds formed over octagon drill steel. These forms were common specimens in exhibitions of minerals thirty years ago. They were so common no one thought them rare, and I know of none now in existence.

Joplin, Mo. JESSE A. ZOOK.

From One Who Knows

THE EDITOR:

Sir—In your issue of May 29 last on page 873 there is an editorial containing what I think must be a misprint. If it is not a misprint the chances are that it will cause a dozen or more red-headed Western mining engineers to leap into print because the manifest inaccuracy of a certain sentence on an important subject will cause widespread misunderstanding. I refer to the last part of the first paragraph of the editorial headed "Development of Prospects," wherein the writer says, "On the other hand, for every mine of this type which proved richer in depth, hundreds show good surface ore and offer," etc., etc. Should not this read in the past tense and say, "and *showed* good surface ore." Without desiring to appear meticulous I cannot refrain from commenting on the fact that there are not hundreds of prospects that now *show* good surface ores, although I readily admit that once upon a time there *were* hundreds of prospects that *showed* good surface ore.

There are already enough misguided eastern engineers in the West fruitlessly hunting for just what this editorial incorrectly asserts as existent—namely, good surface ore.

The mining engineer and economic geologist today in contemplation of new mining ventures in the western part of the United States have to do solely with obscure outcrops; that is, good oreshoots that do not show at the surface. The sooner all of us admit this the more aggressive and successful will the search for new sources of metal become. This class of exploration will be more difficult and costly than the old-time grass-root bonanza prospecting; but the increased cost of diagnosis and discovery of concealed, obscure orebodies will soon be reflected in an increased market price for the metal—the good old law of supply and demand.

It reflects no credit for thoroughness on resident western engineers and miners when you publish an editorial asserting that there are hundreds of good ore showings at the surface. If there were such, one wouldn't need to be a mining engineer to find them. Indeed all the layman would need would be a good jackass and a pick. PERCY WILLIAMS.

Silverbell, Ariz.

Consultation

Improving Precipitation of Silver from Cyanide Solutions

"I have noticed that a high lime content (0.05 per cent CaO in the solution to be precipitated), or a solution fouled by the continuous use of large quantities of "black" cyanide, results in relatively poor precipitation. Can it be that lime (to a lesser extent, I think) and some salt derived from the black cyanide have, both of them, when present in certain concentrations, the property of causing precipitation of a small part of the silver in particles approximating colloidal size, so that the higher press tailings are due to the passage through the canvas of silver in the form of precipitated silver that is too fine to be detected visually?

"Some time ago when we were running under conditions of high lime and all black cyanide we noticed in samples taken from the press discharge small specks of a lead sponge, which rapidly swelled to a noticeable extent. As there could be no question of defective filter cloth, I assume that part of the lead was precipitated in particles so minute that the ordinary press equipment could not prevent their passage through the press. These particles agglomerated in the solution pipe, and the swelling effect observed was probably due to the taking up of liquid."

In answer to the above question, W. E. Simpson, consulting engineer to United Algoma Mines, Ltd., offers the following comment:

The inquiry, in the issue of the *Engineering and Mining Journal-Press* of April 17 as to the cause of "relatively poor precipitation" resulting from "a high lime content (0.05 per cent CaO in the solution to be precipitated); or a solution fouled by the continuous use of large quantities of 'black' cyanide," might be more easily answered if additional information had been made available as to such matters as the assays of the solutions, length of time of contact with the zinc, quantities of zinc dust and lead acetate used, pressure in the precipitating press, and other factors.

The increase in the silver content of the effluent solution from the press may be due to a variety of causes under the circumstances, one of them being, perhaps, too high a pressure in the precipitating press itself. Aëration, as is very well known, is essential for successful cyanidation, and the carbon dioxide, present as a constituent of the atmosphere, will naturally tend to continuously throw down, from a lime-fouled solution, particles of calcium carbonate, so fine as to appear almost in the colloid state. These gradually clog the pores of the filter cloth and create a condition precisely the reverse of that required for efficient precipitation of the silver. Solutions under pressure always have a solvent rather than a precipitating action, and the higher tailings might naturally be expected. A vacuous condition is really what is needed for precipitation purposes; hence the popularity of the Crowe process.

Another cause of trouble may arise through insufficiency in the time of contact between the zinc dust and the silver-bearing solution. Every metallurgist studying cyanide chemistry is familiar with the fact that calcium, as a base, is far less active than sodium, and that calcium, when in contact with zinc, tends to form calcium zincate, thereby retarding the precipitation from a cyanide solution of the precious metals. The time of contact must therefore be increased for a lime as compared with a sodium base; otherwise the precipitating action will be incomplete. Fine particles of zinc dust, continuously diminishing in size, may, under pressure, be forced through the filter cloth; and the precipitating action may be continued outside the press altogether. The minute zinc particles, when released from internal pressure inside the press, may become precipitating agents externally and thus create the very condition observed in which "small specks . . . rapidly swelled to a noticeable size" and "agglomerated in the solution pipe."

Still another cause of trouble in a badly fouled lime solution involving incompleteness of precipitation may arise from the "addition of increasing amounts of zinc." Excessive amounts of zinc are liable to reduce the thiosulphate, present in all working cyanide solutions, to the soluble sulphides, which, in turn, react to form sulphides of silver and zinc. As all soluble sulphides are undesirable in a cyanide solution, their elimination by the use of lead salts is recommended. A large number of reactions may take place under such circumstances, and the best advice in dealing with foul solutions is to avoid having them, if possible, or to replace the lime by the sodium base at the earliest opportunity.

During the time in which the "black" cyanide was being used at the silver mines of northern Ontario, many of the troubles now being experienced by your correspondent were counteracted in Canada by the use of soda-ash, which precipitated the excessive lime and gave an active sodium base with which to operate. This means, of course, an additional expense, but it must be remembered that the sole object of a mining enterprise is to make money for those who invest in it, and that what is wanted is the highest operating profit rather than the lowest cost sheet.

Market for Chemical Manganese

"What is the price of chemical manganese, 70 to 72 per cent manganese dioxide? Your market pages gives a quotation on from 82 to 87 per cent. We have a good grade of chemical ore which we would ship if the price would justify."

There is a market for manganese ore as low as 65 to 70 per cent MnO_2. The price, however, depends more upon the ease with which the mineral can be decomposed so as to liberate the oxygen than upon the manganese content. The physical properties and the absence of iron, lime, or other deleterious substances are the most important requirements of ore used in the manufacture of chemicals, storage batteries, and glass. You might send a good sample of your product to manufacturers in some of these lines and have them determine the suitability of your particular ore for their purpose. Ore of the grade you mention is too lean for storage-battery making, but you might be able to select some of higher manganese content.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

UTAH mines production first half of 1926 surpasses like period of 1925; much construction and development under way—Bingham pays dollar dividend.

Tonopah apex suit settled out of court—Humboldt Sulphur Co. building plant at Sulphur, Nev.

Minnesota iron-mining companies pay state tax of $2,317,270 on $38,620,000 valuation — Ore shipments heavy.

Mayo district, Yukon Territory, a steady producer of silver-lead ore.

Electrolytic zinc plant assured for Kellogg, Idaho.

Commerce Mining & Royalty Co. plans all-steel concentrator—Admiralty Zinc Co. unwatering old Belleville Camp—Velie developing Leopard lease.

Australian gold-mining industry seeks government aid—Platinum production reports issued at Johannesburg.

British Columbia's developed water-power is 414,702 hp., out of a possible 5,103,000.

Anaconda mill and smelter local withdraws from international labor organization.

Copper research studies under way at Houghton, Mich.

Copper Prospecting in Northern Rhodesia

Exclusive Rights Covering 12,000 to 50,000 Square Miles Granted for a Term of Years—Discovery Areas Become Property of Concessionaire

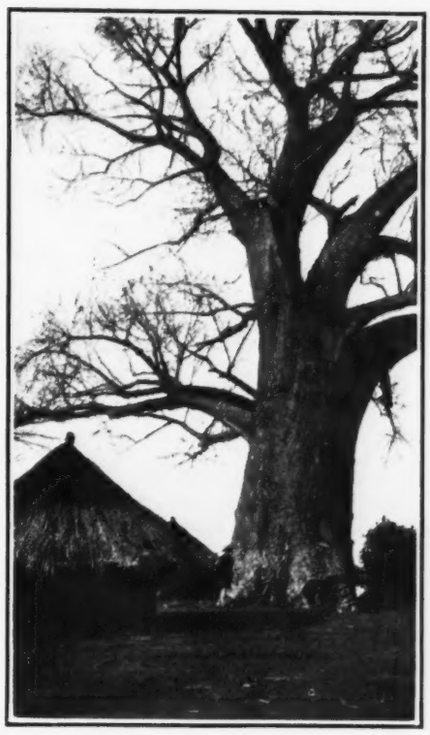
By George L. Walker

6 Eccleston St., East, London, S. W. 1, England

CONDITIONS in Northern Rhodesia are peculiarly suited to prospecting for minerals on a very extensive scale. British South Africa Co., owning the mineral rights over the whole of Rhodesia, is in a position to grant exclusive prospecting rights over large areas for a stated period of years. Those securing such rights are relieved of the fear of stray prospectors jumping in and taking up claims around discoveries, and so have time to effect an organization and prospect their entire area deliberately and systematically.

This is being done. Five companies have together concessions covering nearly 150,000 square miles—an area larger than New York, Pennsylvania, and Ohio. Their exclusive prospecting rights in most cases continue until the end of 1929.

In a porphyry area at least two or three miles wide and probably over fifteen miles long, Rhodesian Congo Border is developing what appear to be large veins of chalcopyrite ore that do not come to the surface. At last accounts ten of these deposits had been located. The indications are that they average about 800 ft. long and vary in width from 15 to 80 ft. Underground openings and diamond-drill holes disclose ore which is estimated to average close to 4 per cent, but neither the widths given nor the assays include the lower grade ore in the walls of these deposits.



One of the big trees in Northern Rhodesia with native hut at left

Several of these veins, but not all, were located by electric prospecting directed by A. Broughton Edge. The results attained by this method have been so satisfactory, diamond drills invariably finding the hidden ore so mapped, that a contract has been signed retaining the services of Mr. Edge for a further two years.

Rhodesian Congo Border also has two deposits of carbonate ore, similar to that of Katanga and of Bwana M'Kubwa, in course of development. The N'Changa-Dambo already is a large mine. At the N'Changa end about a million tons of 3.7 per cent ore has been partly developed above the 100-ft. level, and the 150-ft. level is officially declared to have been opened over a length of 450 ft., the indicated average of the ore being 5.4 per cent copper over widths of 75 to 90 ft.

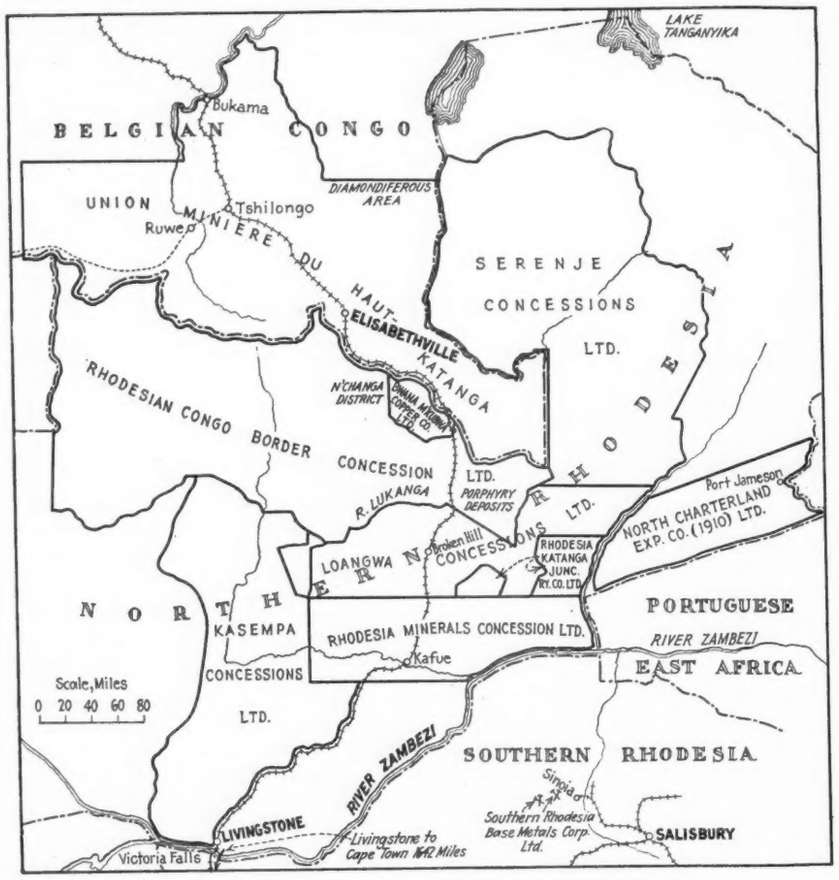
Eleven diamond-drill holes have been put down vertically on the Dambo side, proving the ore to a depth of more than 1,000 ft. and over an area 2,000 ft. wide. These drills cut 75 to 100 ft. of ore ranging from 2.5 to 5.2 per cent copper. Geological conditions are such as to warrant the expectation that 100 million to 150 million tons may be proved in this deposit.

The other deposit of carbonate ore of considerable importance is in the Chifumpa mine. This lies a little way outside of the concesssion, but is under option to Congo Border. When the option was secured it was estimated from work already done that Chifumpa would develop 175,000 tons of 7.6 per cent ore above the 150-ft. level; but work done since is declared to have disclosed ore comparable in grade to that of Katanga.

It is the Chifumpa development that

is responsible for the latest prospecting company, Kasempa Concessions, Ltd., the concession covering the area surrounding Chifumpa, and extending south to Victoria Falls. This mine is more than 100 miles south of Katanga and is indicative of a far-flung copper field in that region.

There is so far surprisingly little disposition to speculate in the shares of these concession companies on expectation of coming discoveries. With the exception of Rhodesian Congo Border, the shares of which advanced to £7 5s., and since have dropped back to £5 5s., shares are at about issue prices. Rhodesia Minerals, though it still has excellent prospects, is quoted at about 15s. These facts are cited to make it clear that the chief aim of the organizers of these companies is to make money by creating wealth, not by selling shares.



Northern Rhodesia and principal copper concessions

The financial construction of these companies is illustrated by that of Kasempa Concessions, Ltd., the last to be floated. It was organized by the United Exploration Co., which received 60,000 shares for its option and services, subscribed £60,000 cash for 60,000 additional shares, and retains an option at par on 75,000 shares until February 28, 1929, on which date (in this particular case) the concession terminates. The remaining 30,000 shares were issued to the British South Africa Co. It is a case of the vendors undertaking to supply the company with £135,000 ($656,100) of working capital.

These companies will not be required to make any further property purchases. Their discoveries become their property when they peg them, the reservation being made that the British South Africa Co. shall receive a royalty of 2½ per cent of the value of minerals produced. This will be only ⅜c. per pound when copper sells for 15 cents.

Application of the Grub-staking Principle

One of the mining engineers associated with these companies, as a member of the boards of directors and a heavy shareholder, says:

"We wish the public to understand that this is the grub-staking priniciple applied on a large scale. If nothing is found the shares are worth no more than a last year's bird's nest. If a company is fortunate in making valuable discoveries and developments, the profits will be large in proportion. While we of course want to make money, our chief desire is to make a success."

As the region is astonishingly rich in copper, and as many of the ore deposits are marked by native workings, the chances of success clearly predominate. Many discoveries have been made, but they are reported only as such until sufficient work has been done to demonstrate their importance. A prospecting party, of which there are many in the field, consists of a practical prospector and an engineer. The entire region is to be thoroughly prospected.

Companies Holding Concessions, and Area of Each

These prospecting-concession companies are controlled by Minerals Separation, Ltd., A. Chester Beatty, Edmund Davis, the Anglo-American Corporation of South Africa, and their associates. The position of their concessions in relation to the Katanga copper belt is shown by the accompanying map. Their issued and authorized capital and the extent of their concessions follow:

	Issued Shares	Par	Authorized Capital	Area, Square Miles
Rhodesian Congo Border...	300,000	£1	£500,000	52,000
Rhodesia Minerals.....	164,833	£1	£200,000	12,500
Loangwa Concessions...	715,000	5s.	£200,000	13,000
Serenje Concessions...	150,000	£1	£225,000	46,000
Kasempa Concessions...	150,000	£1	£225,000	25,000

The companies are given in the order of their formation. All of the other companies apparently owe their existence to the first, the highly valuable discoveries made by Rhodesian Congo Border Concession, Ltd., having created a keen desire to risk money on prospecting in Northern Rhodesia. Perhaps it should be added that the discoveries of Congo Border have been strongly supplemented by those of Bwana M'Kubwa in its N'Kana concession, which is in the same general area.

Tonopah Apex Suit Settled Out of Court; Mining Operations Resumed

Apex litigation of nearly two years' standing between the Tonopah Extension Mining Co., plaintiff, and the West End Consolidated Mining Co., Tonopah "76" Consolidated Mining Co., West End Extension Mining Co., and Halifax Tonopah Mining Co., defendants, covering title to a part of the so called "76" vein, in the southwest portion of the Tonopah mining district, has been settled out of court by compromise.

Defendant companies discovered the "76" vein within their own boundaries and followed it downward on its dip into plaintiff company's ground, on the claim of apex and extralateral rights. In October, 1924, the plaintiff company applied to the district court in Goldfield, and a restraining order was issued preventing further working or extraction of ore until satisfactory title could be shown by defendant companies. Since that time, under various stipulations, considerable preparatory development work has been completed by both plaintiff and defendant companies and the case set for trial June 14, to be heard before Judge J. Emmett Walsh in the Seventh Judicial Court of the State of Nevada, at Goldfield.

The suit was compromised on June 12, and an agreement entered into as follows: Defendant companies were granted apex rights on the vein in question for the entire length of the Seventy-Nine Fraction claim and for a portion of the Tonopah "76" claim, a length of about 700 ft., their rights to terminate 20 ft. above the 1,200 level of the plaintiff company's workings, about 750 ft. on the dip of the vein into Tonopah Extension ground; a vertical side line agreement was entered into, and the suit was dropped.

This decision gives defendant companies clear title to all ore which they had developed in plaintiff company's ground, with additional undeveloped vein to the west.

Minnesota Mining Companies Pay $2,317,270 State Tax

ON JUNE 15, the last day permitted by law without a 10 per cent penalty, twenty-seven mining companies operating in the State of Minnesota paid into the State Treasurer's office a total tax of $2,317,270, which results on a net taxable value of $38,621,176. Of this tax sum the Oliver Iron Mining Co. paid $1,683,185 in three checks, two for a half million each and the third of $683,185.24, and this sum is more than half the entire total of taxes levied by the state in accordance with the occupation tax law on iron ore mined in Minnesota.

Mayo District, Yukon Territory, a Steady Producer

The Mayo silver-lead district, in Yukon Territory, is producing well, according to a report recently issued by Dr. W. E. Cockfield, of the Geological Survey of the Canadian Government. Dr. Cockfield reports that no discoveries of silver-lead ores of major importance were made in this district during 1925, but production from the established properties continued at a steady rate throughout the year, and several properties were brought to the point of production.

Treadwell Yukon Company, Ltd., is the largest producer. This company has been operating a group of claims situated on the western slope of Keno Hill continuously since 1921. The company placed its mill in operation early in 1925, and this marks the first attempt to concentrate the Mayo ores before shipment. Haulage, however, usually takes place in the winter for shipment the following spring, and only a small amount of concentrates is therefore included in the total quantity shipped during 1925. To the end of August, the Treadwell Yukon Company had shipped 1,135 tons of concentrates with an assay value of 584 oz. of silver to the ton and 52 per cent lead.

A number of individual miners also made small shipments from their claims during the year, and there are more groups now engaged at this work than at any time in the history of the camp.

On Galena Hill, immediately to the west of Keno Hill, the veins discovered in 1924 were prospected, and several promising orebodies have been found. One property, consisting of the Arctic and Mastiff claims, shipped 375 tons of high-grade ore.

Bingham Mines Pay Dollar Dividend

Directors of the Bingham Mines company have declared a dividend of $1 a share, payable June 30 to stock of record June 19. This dividend, the second quarterly dividend for the current year, will increase the company's grand total of disbursements to $942,375. The first quarterly dividend of $1 a share or $50,000 in all was paid on March 31.

Utah Mines Increase Production During First Half of 1926

Many Dividend Rates Higher—Much Construction and Development Work Under Way

By Gail Martin
Salt Lake City, Utah

FEAR that production and revenues of Utah metal mines would be seriously curtailed during the current year owing to lower lead prices has been banished by the reports of several representative companies, by recent dividend actions of leading companies, and by the advance of lead to $8. Even if the lead price should not hold above its present level, it is probable that all of the leading Utah producers would maintain their present dividend rates, for the splendid surpluses built up during months of flourishing business would provide ample justification for such a policy. Utah Copper, the disbursement rate of which is over $8,000,000 annually, is the largest single individual payer in the state. Earnings are at a rate that should not require a reduction in dividends even at the present price of copper. Many Utah mines are paying larger dividends than during 1925. Last year, the Utah Copper paid $1 a share, or $1,624,400 per quarter, during the first three quarters, but increased its dividends to $1.25, or $2,030,612 per quarter, the rate now being paid. The Silver King Coalition Mines Co. is paying 25c. a quarter this year compared with 15c. during the first two quarters of last year. Bingham Mines is paying $1 a share, compared with 50c. a share. Production continues high and may surpass last year's record of 21,177,000 oz. of silver and 302,168,000 lb. of lead. Everything depends upon the price of lead. As an example of increased production, two leading companies may be cited. During the first quarter of the year, the silver and gold output of the Park Utah Consolidated Mines Co., the largest silver-producing organization in the state, was considerably in advance of that for the first quarter of last year. Lead production was about the same. The Tintic Standard Mining Company had during the first quarter of 1926 the best three months in its history. Lead output increased to 9,247,255 lb., compared to 9,073,080 lb. for the first quarter of 1925; silver to 946,578 oz., as compared with 819 015 oz.

If there have been certain individual mines which have not been able by increasing output to maintain income at or above the rate for last year, improved production in such mines as the Chief Consolidated, the Plutus, the Mammoth, the Honorine, and others should more than offset any loss in production. Recent discoveries in the Silver King Coalition mines and the installation of new hoisting and pumping equipment in the Park Utah indicate that these companies will be able to increase production. Production at the Utah Delaware of the International Smelting Co. will probably be larger than last year. Increased prospecting activities in the West Tintic, the Star, the Lincoln, and the Tintic districts may add materially to metal output. The strides made in lead-zinc metallurgy by the Combined Metals Reduction Co. at Bauer, Utah, the International Smelting Co. at Tooele, and the beginning of operations at the new 1,000-ton flotation plant of the United States Smelting, Refining & Mining Co. also are factors that should stimulate output in Utah.

Installation of additional flotation machinery, 250 tons' daily capacity, (Minerals Separation) and 600 tons, (Callow cells), making an increase of 850 tons daily, at the Silver King Coalition Mines Co. at Park City, is another indication of the health of the Utah metal-mining industry. This company is now operating a flotation plant of 1,000 tons' daily capacity. Division of this department between the Mineral Separation and the Callow cells is about equal. Part of the new equipment will be used for re-treating concentrates to increase the grade of the zinc-lead product, and part to rework mill tailings. Additional buildings will not have to be erected. Last year the company provided space for enlargement of its flotation department.

Electrolytic Zinc Plant Assured for Kellogg

It was officially announced on June 17 that an electrolytic zinc plant will be built at once at Kellogg, Idaho, by the Sullivan Mining Co., owner of the Star mine, stock of which is owned equally by the Bunker Hill & Sullivan and Hecla Mining companies. The initial capacity of the new plant will be 50 tons of refined zinc per day, but it will be so constructed that additions may be made readily. It is understood that in addition to handling ore from the Star mine, custom ores will be handled also. The estimated cost of the plant is $1,000,000, and the work will be done under the direction of James F. McCarthy, of the Hecla Mining Co., and Stanly A. Easton, of the Bunker Hill & Sullivan company.

Humboldt Sulphur Building Fifty-ton Plant

The Humboldt Sulphur Co. is erecting a fifty-ton mill to treat the ore from its sulphur deposits at Sulphur, Nev., on the Western Pacific railroad, 120 miles northeast of Reno. Operations are to begin soon. The sulphur deposits at Sulphur, on the edge of the Black desert forming an old Tertiary lake bed, have been worked desultorily for sixty years. Under the direction of Arthur J. Crawley, the company is planning to develop reserves estimated to contain over 150,000 tons of 35 per cent sulphur ore. A hot-water process for treating the ore has been worked out by H. L. Hazen, of San Francisco.

News From Washington

By PAUL WOOTON
Special Correspondent

Pittman Silver Purchase Bill Passes Senate and Is Referred to House Committee

Senator Glass, of Virginia, so impressed members of the Senate in an argument he made against the Pittman bill, that he failed by only two votes to secure the reconsideration of the measure, which the Senate previously had passed without a dissenting vote. The line of the Virginia Senator's argument is indicated by the following extracts from his remarks:

"The sole question hangs upon a legal refinement—upon the technical question of whether or not an 'allocation' not made effective is in fact an allocation, and whether under those circumstances the Secretary of the Treasury had the legal right to revoke the allocation."

The allocation referred to is the 14,589,730.13 oz. of Pittman silver used for subsidiary coinage and subsequently replaced with silver purchased at the world price.

"The contention here," continued Mr. Glass, "is that the 'allocation' for a given purpose once made by the Treasury is effective whether it is put into execution or not. The contention is that the Secretary of the Treasury had no legal warrant for revoking the allocation. The contention is that the Secretary of the Treasury had absolutely no discretion whatsoever in the administration of the requirements of this law.

"If he is in error and there is any aggrieved interest it is competent for that interest to appeal to the courts to compel the Secretary of the Treasury to correct his mistakes. . . . The silver producers have reaped a harvest of profit out of this transaction from the beginning to the end. Out of this entire transaction the Secretary of the Treasury assures the Congress that the producers of silver in this country already have derived a bonus of nearly $59,000,000, which is the difference in the price fixed in this bill for the repurchase of silver and the price whereby the Treasury might have purchased the silver in the open market. If the Senate wants to give these gentlemen $5,000,000 out of the Treasury, it will vote against the reconsideration of this bill."

Senator Pittman told the Senate that there is no foundation for the claim that the silver miner is given a bonus of $59,000,000. "The government turned over to the miner the $1 it got from Great Britain for each ounce," said the Nevada Senator.

Senator Pittman reviewed the entire transaction and presented his reason for believing that the original Pittman Act will not have been complied with until an additional 14,589,730.13 fine ounces of silver have been purchased.

Whether or not the Committee on Banking and Currency of the House reports out the bill at this session has no important bearing on the prospects of the legislation. The bill does not die at the end of this session. It will have all of the second session of this Congress in which to get through the House.

Bureau of Mines Continues Reorganization Plans

With the approach of the new fiscal year, plans of the U. S. Bureau of Mines for the organization of its economic work are beginning to take form. Director Scott Turner and Assistant Director C. P. White up to the present have made no secret of the fact that they have been marking time in the economic branch of the Bureau's activities awaiting the availability of funds carried by the 1926-1927 appropriation act.

Although the broad features of the Reynders Committee's report recommending the centralization in the Bureau of Mines of the work on the economics of mining have been carried out in part, the details for handling the work inside the Bureau have not been worked out finally. Mr. White's hands have been tied by the complexities of regulations covering the handling of appropriations. Another uncertainty has been removed in the decision of Congress not to pass coal legislation. A discussion of the plans will be given later.

Mining Engineer Awarded Verdict

THE jury in the case of John Carter Anderson, mining engineer, vs. Arizona-Superior Mining Co., Phoenix, Ariz., awarded a complete verdict for Anderson recently, after deliberating on the case about thirty minutes. Anderson sought $750 as a fee due him for an examination of and report on the mining company's property. The company had refused to pay the amount after rejecting Anderson's report and entered a counter claim for $50,000 damages for alleged falsity in the report and a conspiracy with a promotion company to depreciate the property.

Kirkland Lake Developing Good Ore on Deep Levels

At the Kirkland Lake mine, Kirkland Lake, Ontario, drifting operations on the 2,100 level have opened up from 175 to 180 ft. of high-grade ore, and a quantity of medium-grade ore is also in evidence. The value of the ore continues high, averaging about $40 a ton, but the ore on 2,225 level is not so rich. Drifting to the east is being carried out on the 2,100 level, and the 2,225 level is being opened up both east and west. To the east an ore-shoot about 125 to 130 ft. long has been proven, and to the west it has been opened up for about 50 ft. Values of ore on this level are from $15 to $25 a ton.

Active development operations have been begun on the Macassa property at Kirkland Lake. The mine has been dewatered and a compressor has been installed. Some diamond drilling has been done. A shaft has been sunk to 525 ft., and there is also a complete mining plant and equipment. Operations are in charge of A. J. Keast.

About 300 Square Miles Staked at Red Lake

The records of the Ontario Department of Mines show that up to date the area staked out in the Red Lake division of Patricia district is about 35 miles in length by a width of 4 to 15 miles from north to south. The staking activity of the last four or five months has seldom if ever been exceeded in the province.

Three Manitoba Companies Plan Merger

Negotiations have been closed for the amalgamation of the Central Manitoba Mines, Ltd., Anglo-Canadian Explorers, Ltd., and the W. A. D. Syndicate, operating in central Manitoba. A charter has been applied for incorporating a new company capitalized at $4,500,000. John Taylor & Sons, of London, England, are largely interested. Development work is to be undertaken immediately, and it is proposed to construct a modern mill, work on which will be started during the winter.

Michigan Copper Research Advisory Committee Plans Extensive Program

In the study of various problems of the copper industry in the Michigan district, the U. S. Bureau of Mines, Michigan Geological Survey, and the Michigan College of Mines, Houghton, will co-operate with the Copper Research Advisory Committee recently formed at the copper conference at Houghton.

It is believed that something can be accomplished along the following lines: Clarifying ideas on various practices; standardization of equipment; study of the physical and chemical properties of copper; magnetic dip needle testing of small areas to determine the feasibility of this method of exploration; drill-steel testing to reduce breakage and increase efficiency; accumulation of information on methods of deep mining; study of rock pressures and subsidence; study of ventilation; study of the comparative hardness of the various ores; greater elimination of gangue from mineral to give a higher percentage of copper; reduction of copper losses in tailings and slag; and study of the economics of the copper industry and promotion of new uses for the metal.

British Columbia's Developed Water-Power Amounts to 414,702 Horsepower

Some idea of the amount of water-power being used by the mining industry of British Columbia is given in a report just issued by the Natural Resources Intelligence Service of the Canadian Government. This report says:

"The mining industry makes extensive use of water-power in the district surrounding Nelson. Here the West Kootenay Power & Light Co., controlled by interests allied with the Consolidated Mining & Smelting Co. and the Canadian Pacific Railway, has power installations totaling 77,900 hp. The East Kootenay Power Co.'s developments on the Bull and Elk rivers, supplying Fernie, Cranbrook, and other towns in the Crowsnest coal mining region with electric energy, total 22,200 hp. In the coastal region several large mining enterprises have developed power from water. At Britannia, on Howe Sound, north of Vancouver, the Britannia Mining & Smelting Co. utilizes 22,350 hp., the most of which is developed under a 1,920-ft. head. At Anyox the Granby company uses 13,400 hp. developed from water. On Vancouver Island, Canadian Collieries (Dunsmuir) Ltd., has a 12,000 hp. installation on the Puntledge River. Many other mining companies scattered throughout the province have developed near-by water powers for use in mining and smelting operations."

The report further states that the total available water-power in British Columbia at minimum flow is estimated at 1,931,142 hp., and at 5,103,460 hp. dependable for six months. The power developed at the end of 1925 amounted to only 414,702 hp.

Iron-Ore Mining Gains

Mining operations are being steadily increased on the Minnesota ranges. Additional men are being taken on by the Oliver Iron Mining Co. and the independents. Ore shippers were hampered in May through steamers being delayed in making their round trips by ice conditions at Buffalo. May shipments on that account fell below earlier expectations, but heavy movement is looked for in July and succeeding months during the season.

Open-pit mines in Hibbing and Virginia districts are loading considerable ore. Movement from Cuyuna range is expected to be the largest in years this season, with more active demand for manganiferous ores.

Anaconda Local Withdraws From International Organization

The Anaconda local, International Union of Mine, Mill and Smelter Workers, by a vote of 12 to 1 has withdrawn from the international organization. The vote, one of the heaviest ever cast by the local, was an indication of the feeling that the members have derived no benefit despite the fact that in the last 23 years they have paid approximately $250,000 into the treasury, according to George McArdle, secretary.

Admiralty Zinc Unwaters Belleville Camp

The Admiralty Zinc Co., Douthat, Okla., has started dewatering the old Belleville camp, in Missouri, six miles northwest of Joplin. A 10-in. pump has been installed and the water is being lowered about a foot a day. The Belleville camp was a good producer twenty years ago. The Admiralty company also is sinking a shaft on the Missouri Lead & Zinc Co.'s property, southeast of Joplin. It has about 1,000 acres of land under lease in this territory, and reports some good orebodies developed by drilling.

Golden Rod Plans Mill

The Golden Rod Mining & Smelting Co., Joplin, Mo., has turned back the options it held on the Long Hunt and Qua-Jack leases, east of the Hope Mining Co.'s property in the Picher section of the Joplin-Miami field. It is pushing development on the Weiss land, just north of the returned leases, and plans construction of a mill.

Commerce Plans All-Steel Concentrator

The Commerce Mining & Royalty Co., Cardin, Okla., will replace the concentrator recently lost by fire on the Blue Goose lease, in the Joplin-Miami field, by building an all-steel mill. This will be the second steel mill in the district, the Anna Beaver Mining Co. having one now near completion a short distance north of the Blue Goose. The Blue Goose mill fire started in the derrick, while the plant was in operation. The mine has been worked ten years or more, and has been a large producer, and recent drilling has convinced the owners it is good for at least another ten years, thus justifying the construction of a steel mill. The loss of the frame structure with plant was estimated at $80,000.

Consolidated Mining Exploring Chrome-Iron Deposits

The Consolidated Mining & Smelting Co. of Canada has a dozen men on exploration work at the summit of the Rossland-Cascade link of the transcontinental highway, on a group of claims on which some good specimens of chrome-iron ore have been found. A good deal of exploration was done on these claims toward the end of the war, but work stopped with the cessation of hostilities.

Velie Developing Leopard Lease

The Velie Mining Co., Joplin, Mo., has started development of its Leopard lease in the Joplin-Miami field, which was under option to Frank Childress, of Joplin. He paid $25,000 cash for the option and was to pay an additional $175,000 if he closed it. After considerable drilling, however, he turned it back, stating that fair ore prospects had been shown. The Velie company has started deepening of the shaft already on the lease, with the intention of going below the 300 level.

Consolidated Mining Will Ship 16,000 Tons Zinc Concentrate to European Ports

A dispatch from New Westminster, B. C., states that the Consolidated Mining & Smelting Co. of Canada has made arrangements for the shipment of 16,000 tons of zinc concentrate from that port to Europe and that shipping will start early in July, the first 6,000 tons having been booked by the Canadian Government Merchant Marine ships. Between Jan. 1 and May 30, 222,549 tons of ores and concentrates have been received at the smelter, of which 174,612 tons came from the Consolidated company's mines and 47,927 from independent operators: the latter compares with 44,419 tons from independent operators, out of a total of 377,890 for the whole of 1925. The chief independent contributers during the first five months of this year were the Allenby Copper Corporation, Allenby, 13,040 tons; Bluebell, Riondel, 7,372 tons; Lucky Jim, Zincton, 7,260 tons; Whitewater, Retalleck, 2,490 tons; Yankee Girl, Ymir, 2,790 tons; Silversmith, Sandon, 2,081 tons; McAllister, Three Forks, 1,862 tons; Cork-Province, Zwicky, 1,278 tons; Stemwinder, Kimberley, 1,009 tons; Galena Farm, New Denver, 826 tons; Ruth-Hope, Sandon, 702 tons; and Paradise, Invermere, 501 tons. Moreover, shipments of custom ores during the summer and fall will be still heavier, as they are increasing facilities.

The Consolidated has put its new 500-ton mill at the St. Eugene mine, at Moyie, in operation and expects to have the new 1,000-ton unit at its Sullivan mill in operation by Aug. 1 or earlier.

British Columbia May Have Iron and Steel Industry

E. A. Haggen, who has just returned from Europe, states that a British syndicate has arranged to establish a small-scale iron and steel plant on the Pacific coast of British Columbia, and an engineer now is on his way to make arrangements for the construction of the plant. Mr. Haggen also states that a British company, which has secured the rights of a Belgium process for treating lignites, is investigating the possibilities of the Hat Creek coal field, 13 miles from Pavilion, on the Pacific Great Eastern Railway.

The registration of the Bethlehem Steel Co., at Bethlehem, Pa., with an authorized capital of $100,000, appears in the last issue of the *British Columbia Gazette*. The proposed activities of the company are not stated. The branch office of the Bethlehem company is Vancouver, B. C.

Ruby Beach Mining Co. Defunct

The Federal Grand Jury, at Tacoma, Wash., has indicted thirty-one persons for fraudulant use of the United States mails in connection with defunct Ruby Beach Mining Co., of Aberdeen, Wash. The company claimed to have perfected a process for the recovery of gold from the beach sands at Aberdeen. About 1,000 investors are said to have been swindled out of $300,000.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Teck-Hughes Ore Production 7,000 Tons per Month; New Mill Considered

Recent developments at the Teck-Hughes property, Kirkland Lake, have been extremely satisfactory. The big oreshoot on the 11th, 12th and 13th levels has been proven for a length of approximately 700 ft. and is expected to average 15 to 18 ft. in width, of high-grade ore. Drilling below this level has indicated ore of corresponding grade to a depth of 2,500 ft. The company has had the construction of a new mill under consideration for some time and would be prepared to make a definite decision if it were not for the high power prices charged in Kirkland Lake, which vary from $65 to $95 per horsepower-year, as against $25 to $50 in other places. Production at the Teck-Hughes runs from $145,000 to $150,000 a month, and the mill is handling about 7,000 tons a month.

The production of the Kirkland camp, which in 1925 was $5,600,000, is now running at the rate of $7,000,000 to $8,000,000 a year, and this rate will again be increased in the near future.

Sylvanite Gold Increases Capital

At a recent meeting of the Sylvanite Gold Mines, Kirkland Lake, the directors were given the authority to increase the capital stock of the company from 3,000,000 shares to 3,300,000 shares. The additional stock will be offered to shareholders pro rata at $1.25 per share, and the money will be used for the construction of a 200-ton mill. The ore reserves are estimated at $2,000,000, which the directors believe to be conservative and sufficient to justify the installation.

Keeley and Canadian Lorrain Report New Developments

At the annual meetings of the Keeley and Canadian Lorrain mines, held in Toronto, June 17, officials told of the new developments since the issue of the annual reports. In discussing the Keeley the managing director stated that since the end of the fiscal year, Feb. 28, there had been a distinct improvement in underground conditions. A number of oreshoots have been found in various parts of the mine, which are being developed, but which have not yet reached the stage to permit giving definite figures as to the actual quantities of ore.

At the Canadian Lorrain property, Silver Center, Ont., which is about four miles from the Keeley and controlled by the same interests, the No. 5 vein, which gave 40 oz. over 42 in. for a length of 165 ft., on the 250 level, has been opened up on the 150 level for 67 ft. and shows an average of 105 oz. over 48 in. Another good oreshoot has just been cut on this level. Construction has been started on the foundations for a new mill, and material and equipment are beginning to arrive on the ground.

The Mining Corporation will explore the lower diabase Keewatin contact at its South Lorrain properties, and a two-compartment winze will be sunk 600 ft. below the 7th level, or a total of 1,250 ft. from the surface. All the ore produced in South Lorrain to date has come from the upper contact, but in view of the experience in the Cobalt district and the strength of the South Lorrain veins, there is reasonable ground for believing that the lower contact may also prove productive. The company has declared an interim dividend of 12½c. per share, payable July 15.

Greene Cananea Testing New Copper Deposit

Greene Cananea Copper Co., Cananea, Mexico, has struck low-grade copper ore in two churn-drill holes in porphyry ground in the vicinity of Democrata Gulch. The company intends to explore the area further, but until two or three additional holes have been drilled it is impossible to form any trustworthy opinion as to the possibilities of this area. Probably several months of additional drilling will be necessary to obtain sufficient data as to the value of this new find.

Holman Cliffs Mining Company Formed

The Holman Cliffs Mining Co., Hibbing, Minn., on June 15 filed articles of incorporation at St. Paul, with a capitalization of $1,000,000. The incorporators, all of them officers of the Cleveland-Cliffs Iron Co. residing in Cleveland, are S. L. Mather, C. O. Mahon, H. A. Raymond, and Charles G. Heer. Holman Cliffs Co. has taken over the Holman-Brown properties near Taconite, Minn., that were formerly operated by the Oliver Iron Mining Co. but were relinquished last year. The Mesaba-Cliffs Iron Co., also a subsidiary of the Cleveland-Cliffs Iron Co., has the Bingham and North Star mines, which adjoin the Holman pit on the north and south, and these with the Holman form a reserve of approximately 3,500,000 tons.

Thirty-Five Locomotives Operating in One Minnesota Mine

The Missabe Mountain mine, operated by the Oliver Iron Mining Co. at Virginia, Minn., is one of the busiest mines on the Mesabi range this year. It is operating ten shovels and thirty-five locomotives and expects to get out 6,000,000 tons of iron ore during 1926.

Alaska Railroad Reduces Operating Deficit

A reduction of $394,692 in the deficit of the Alaska Railroad was effected during the first nine months of the current fiscal year, according to a report of the U. S. Interior Department. The report shows that the deficit for this period in the fiscal year of 1926 was $611,608 as compared with $1,006,300 for the same period of 1925. An increase in the operating earnings of the railroad amounting to $107,901 occurred during the first nine months of the year, and operating expenses were reduced by $286,791.

London Letter

By W. A. Doman

Special Correspondent

South African Gold Shares Advance—Rhodesian "Prospects" Meet Ready Sale

London, June 8—Partly on account of the dividends to be declared during the current month, South African gold-mining shares have been revitalized. It is more or less a seasonal move, and enables some of the holding companies to dispose of stock they have nursed for a considerable time. Finance companies do not always keep securities for income purposes, and some of them, to avoid payment of taxes, have been known to work up quotations, sell shares just previous to their being marked "ex dividend," and repurchase after the deduction.

Operating costs in the mines are being lowered, but the Union Government claims a pretty substantial proportion of profits. Recent encouraging disclosures on the Sub-Nigel property in the Heidelberg district of the Transvaal—the far southeast of the Rand basin—have stimulated interest in various properties in the vicinity, and the share market is active in consequence.

Apart from Rand gold shares, attention is being directed to base-metal mining ventures, particularly in Rhodesia. Edmund Davis and one or two other well-known financiers and experts are at present on the spot, and the upward move in prices is largely attributed to what are regarded as their views of the prospects. At present "prospects" seems to be the most suitable description for these areas. I have had an interesting chat with one of the most prominent men in the Rhodesian market, and he shakes his head at the way in which prices of copper shares are being rushed up. He says the pace is too fast, as little is yet actually proved. In several places indications are good, and capital assays have been taken, but it remains to be seen whether mines can be developed. He does not desire to see Rhodesia lose her reputation at this early stage, and three or four years must elapse before even the best of the new discoveries can be converted into producers.

According to reports received from Bucharest, an Anglo-Belgian group is making tenders for the acquisition of manganese mines situated in the Hunoadoara district.

Panama Concessions in Limelight

The Panama Concessions have come into the limelight. Elliott Alves, the moving spirit in the undertaking, says the statements made in Washington are incorrect and have no foundation whatever. The possible value of these concerns, he says, has always been realized and appreciated by those responsible for their acquisition, and no surprise whatever has been occasioned at the sudden awakening to their value in the United States. The British Government has no interest in them, nor was that government concerned in their acquisition.

Melbourne Letter

By Peter G. Tait

Special Correspondent

Gold Mining Industry Seeks Government Aid—Subsidizing of Galena Prospectors Suggested

Melbourne, May 18—The Commonwealth Government recently appointed a commission to consider the disabilities suffered by Western Australia as a result of federation, and subsequently parliament made a grant of £450,000 for the current financial year. Those interested in the gold-mining industry have strongly urged the Western Australian Government to utilize this grant to assist the industry, and during a recent visit of the Premier and other members of the Cabinet to Kalgoorlie the occasion was taken to press this request. The Premier in his reply stated that the government was prepared to devote a part of the money toward the relief of the industry, but the government, will, first of all, have to be satisfied that the money would be used in such a way that it would not merely prolong the life of the mines for a short time but be of permanent benefit. It has been suggested that one way in which the gold-mining industry of Kalgoorlie could be helped would be the provision of a central power plant, and the government has offered to assist the Kalgoorlie Electric Power Corporation to extend its plant so that all of the power requirements of Kalgoorlie can be met, if the companies indicate their willingness to take all their power from that company.

New Lead Deposit in Western Australia

Considerable interest is being manifested in the Braeside lead deposits, situated 250 miles from Port Hedland on the northwest coast of Western Australia. T. Blatchford, state mining engineer, recently visited the field, and has recommended a full geological survey and the subsidizing of prospectors to develop the galena outcrops. C. M. Harris in an article to be published in *Chemical-Engineering & Mining Review* states that "The workings of the most practical interest have been done on the Ragged Hill lease toward the south end of the belt, where rich galena was found on the surface many years ago. A shaft has been sunk to a depth of 90 ft., and it is proposed to continue this to water level, which, judging from a water shaft sunk in the valley below, will be about 130 ft. On the surface there was about 60 in. of galena and 12 in. of galena-bearing quartz on each wall. At a depth of 10 ft. this began to oxidize and lead carbonate replaced the sulphide, the value decreasing to about 40 per cent lead at 60 ft. Here patches of galena came in again, and at 88 ft. the lode is reported to be maintaining a grade of 40 per cent over the width of 60 in. The galena-bearing quartz outcrop can be traced for a length of 1,800 ft., with a more or less continuous shoot over a length of about 250 ft., with a possible average of about 25 per cent lead over a width of 2 to 3 ft. Until such time as the lode has been tested at water level, it is unfair to say that it will not open out to a bigger width. The Mines Department of Western Australia realizes this, and is assisting the owners to carry out the development of the lode to water level."

Further, he states that "The longest apparently continuous shoot of galena is on the Braeside North lease, which we were able to trace for 870 ft. in length, but the galena-bearing quartz is only narrow (6 to 24 in.)."

As with so many prospective mining fields, the successful development depends on the price of metals and transport. The field is 100 miles from the rail head at Marble Bar, and under present circumstances the cost of transport to Fremantle by camel, motor wagon, rail, and boat is £11 per ton, to which must be added all the costs associated with the production of the ore. Notwithstanding this, however, if it can be shown that the deposits are of sufficient extent to warrant development the Western Australian Government or private interests would soon find the wherewithal to extend the railway.

Mount Isa Ore Under Test

The Mount Isa Mines, Ltd., has commissioned T. M. Owen to install an experimental plant in Sydney to prove the suitability of the acid-leaching process evolved by W. H. Corbould. The company is also sending a representative sample of the carbonate ores to the United States for treatment by the Tainton brine-leaching process. This process was investigated by Mr. Owen while in America last year, and preliminary tests on Isa ores have already been made by Mr. Tainton with encouraging results.

Commonwealth Oil Has Deficit

The Commonwealth Oil Refineries in its report for the year ended June, 1925, shows a deficit of £53,812. The refinery, it is stated, was operated at only about one-third of its capacity, but as it is now working at full capacity the current year's operations are expected to show a better result. The Commonwealth Oil Refineries is the joint property of the Anglo-Persian Oil Co., Ltd., and the Commonwealth Government. Its paid-up capital is £750,000. The company's products are favorably known on the market. The "C.O.R." motor spirit sells at 2s. per gallon, as compared with 2s. 2d. charged by the principal importers.

High-Graders Still Active

A terrible tragedy was enacted in Kalgoorlie early in May. Detective Inspector Walsh and Detective Sergeant Pitman, of the detective staff at Kalgoorlie, assigned to prevent the stealing of gold, left the town on April 27 to investigate a case that had come under their notice. Their failure to return led to the formation of search parties to scour the district, and ultimately their mutilated bodies were found in a drift from an abandoned shaft, a few feet from the surface.

Johannesburg Letter

By John Watson

Special Correspondent

Safety-first Campaign Brings Good Results in South Africa—Stock Prices Advance

Johannesburg, May 18—At the Geduld Recreation Hall, on May 7, P. M. Anderson, the chairman of the Union Corporation, Ltd., congratulated the Geduld Proprietary mine on its record in the safety-first campaign, which originated in 1911. From that date, the fatal-accident rate had diminished. In 1911, it was 4.1 per 1,000 and there were 880 deaths in the mines of the Union of South Africa; in 1925 the rate was 2.4 per 1,000 employed and the deaths numbered 472. The accident rate on Geduld last year was 0.63 per 1,000, the third lowest on the Reef. The two mines with better records last year were New Kleinfontein and Modder Deep. In 1915, Geduld won the shield for the best record in any class in the competition on the mines.

Platinum Production Reports Issued

On May 13th the Rand Mines, Ltd., issued the results of platinum production of the Transvaal Platinum, Ltd., whose property is situated near Naboomspruit, Waterberg district. The reduction plant started on March 15 and is working smoothly. Twelve hundred tons were milled up to April 30. The crude platinum produced is estimated to contain 89 oz. of platinum and allied metals. It is hoped that a better recovery will be obtained from current operations. The results of April crushing at Onverwacht (northwest of Lydenburg) were issued on the same day. The reduction plant there milled 845 tons during the month, the crude platinum from which is estimated to contain 545 oz. of platinoids, equal to 12.9 dwt. per ton milled. The tonnage was restricted, owing to the short month, which included Good Friday, and because of a temporary mechanical breakdown, which put the ball mill out of action from April 10 to 16. Crushing is now proceeding at the rate of about 50 tons per day. Refining operations in London are proceeding smoothly, and the output of refined platinum is being disposed of at satisfactory prices. The prospecting shaft at Onverwacht, which is being sunk below the 250-ft. level, has disclosed thirty-six feet of ore, containing 10.7 dwt. platinoids per ton. On the Johannesburg Stock Exchange, during the last week, the share market was firm, owing to the cheerful attitude of the London market during the general strike. When news came on May 12 that the general strike had been called off, there was a miniature boom. The dealing in Sub-Nigels has been enormous, and their price increased during the week from 30s. to 36s. 6d. Lace Proprietary shares improved from 9s. to 13s. owing to the fact that it has a property adjoining the Sub-Nigel. T. C. Lands improved from 50s. 6d. to 52s. 6d. Potgietersrust Platinum also improved.

Societies, Addresses, and Reports

Engineering College of Cincinnati University Renders Novel Services to Industry

E. J. Mehren Explains "Integration" of Functions—Plan To Develop Area Tributary to City—Survey of Basic Resources Is Feature

In the current issue of "Engineering News-Record" E. J. Mehren, vice-president of the McGraw-Hill Publishing Co., describes a novel organization of the activities of the College of Engineering, at the University of Cincinnati, designed to give practical assistance to industry. The following are excerpts from the article:

Realizing that industry is the dominant factor in America's economic life, and that through its development America will further the welfare of its people and give them opportunity for the greatest self-development, the University of Cincinnati has worked out, under the headship of its College of Engineering, a co-ordination of six services to industry. It advises on raw materials, it conducts industrial and basic-scientific research, it has colleges of engineering and of commerce, and a school of applied arts. Through its Basic Resources Survey it can tell a manufacturer what raw materials are available in the Cincinnati district. It is prepared to study these, and other materials, in its Institute of Industrial Research. It can take the most fundamental problems into its Basic-Science Research Laboratory. And then, having helped to find materials and to solve the underlying production problems, it prepares in its College of Engineering the future engineers and production executives; it trains in its College of Commerce men and women for the distribution departments of industry; and, finally, will furnish industry, through the School of Applied Arts, artists trained to add beauty to products already useful and imbued with an understanding of the limitations imposed on design by modern production methods.

Cincinnati, therefore, has taken a leaf from industry's own book; it has "integrated" the services that a college can render industry. Somewhat similarly, the steel companies mine their own ore, and limestone and coal; transport these materials on their own ships and railroads; make their own pig and billets and sell through their own organization the finished shapes, tinplate and wire. Cincinnati's College of Engineering does not produce materials, but it does touch industry at various points. The service it renders will be the better by reason of the single control of its relations to industry, just as the service of the steel industry to the public is bettered by integrating the various steps of production and distribution into one organization.

Of course, other colleges and universities perform some of these services for industry. Industrial research bureaus are a rather common adjunct of engineering colleges; most large universities have colleges of commerce; some have state geological surveys associated with them. The distinctiveness of Cincinnati's plan is that all these services—and two additional ones, the Basic-Science Research Laboratory and the School of Applied Arts—are all part and parcel of the College of Engineering.

Out of this integration would necessarily result—if it had not preceded—an unusually searching examination of the function of industry, of its needs in the way of scientific information and trained personnel, and of the ways in which the college can meet these needs. As a matter of fact, this searching examination had run before—and had not followed after—the setting up and coordination of these services. The needs of industry, keenly appreciated, brought about the logical addition of the successive elements.

The guiding hand in the development of the plan, its originator and operating executive, is Herman Schneider, dean of the College of Engineering and Commerce. It represents the fruition of the work initiated by him twenty years ago in the establishment of the co-operative system of engineering education. His contact with industry, through the co-operative plan, has been most intimate. His understanding of industry's needs has been proportionately clear. The services, therefore, have each been definitely shaped from their beginnings. As a result they have met with hearty response from industrial executives.

The survey of the resources of definite areas is not new. The novelty of Cincinnati's Basic-Resources Survey lies in the spirit in which the work was undertaken—as a service to Cincinnati and its neighbor towns of Newport, Covington and Dayton—and in the application to the bare survey data of the engineering knowledge and industrial experience of the faculty of the College of Engineering and Commerce. In addition, certain specialists have been retained to make particular analyses of some of the reports. The survey data have now been gathered; the studies based on them are still under way.

The underlying thesis of this survey is that the University of Cincinnati, as a municipally supported institution, owes an allegiance to the industries which created and maintain the city and its college. The survey has, therefore, been limited to a study of the basic resources of the area economically tributary to Cincinnati — the territory within 200, or in some cases 300, miles of the city. Also considered as logical resources, if not basic, are those raw materials that pass through Cincinnati *en route* to other points, there to be processed or fabricated and hauled back to Cincinnati for sale.

The field surveys have been principally geologic, carried on under Dr. Nevin M. Fenneman, of the department of geology of the university. These have been supplemented by studies of agricultural resources and of products passing through Cincinnati. The titles of some of the reports show the scope of the inquiry: Concrete Products, Coke Ovens, Artificial Silk, Portland Cement, Lime Resources, Zinc and Lead, High Silica or Glass Sand, Tobacco, Salt, and Barytes.

Having determined the resources, the remaining problem is to answer the following questions: (1) To what extent are these resources used by industries in Cincinnati or its neighboring towns? (2) What new industries, using these materials, can economically be established at Cincinnati? (3) What raw or semi-finished products passing through Cincinnati to other points, to be shipped back finished, can be economically turned into finished products in the city? (4) Finally, what materials, containers, etc., bought elsewhere to complete or pack products, can Cincinnati manufacture economically and thus make its industrial chains complete?

Mining Men Talk for Montana Society of Engineers

At the May meeting of the Montana Society of Engineers, held in Butte, Earl V. Daveler, general manager of the Butte & Superior Mining Co., presided and the chief speakers were Reno H. Sales, head of the Anaconda geological department; George M. Fowler, geologist for the Anaconda company, and Samuel Barker, Jr.

Mr. Sales spoke on dewatering problems at the Geisches Erben properties of Germany-Poland, stating that great amounts of water had to be handled because of the pervious character of the formation and that the orebody was located in a kind of a "sink." He described some peculiar formations made by the percolating waters.

Mr. Fowler spoke on "Observations in the Tri-State Mining District," explaining the methods of exploration, shaft timbering through the overburden, contract shoveling, and hoisting in "cans." He stated that since 1908 the district has produced 186,000,000 tons of ore, and that the zinc concentrates therefrom totaled 6,490,000 tons, with an average tenor of 60 per cent. Since 1850 the district has produced metals of a money value of $620,000,000.

M.I.T. Summer Mining Camp Opens in July

The summer mining camp of the Massachusetts Institute of Technology, which has been conducted at Dover, N. J., near the mine and plant of the Replogle Steel Co., for the last few years, will be held again this summer. Walter C. Eberhard is director. The date set for opening is July 26, on which day also the work in surveying will start. The surveying course will end on Sept. 14, and on the day following the one-week course in mining practice will begin, followed by a few days' work in field geology. The camp will close on Sept. 25.

People You Should Know About

J. A. Burgess, consulting engineer and geologist of San Francisco, is in southern Nevada on professional work.

Charles A. Mitke, consulting mining engineer, of Bisbee, Ariz., has been in New York for a month on consultation work.

L. S. Cates, vice-president and general manager of the Utah Copper Co., is in Salt Lake after a visit to New York.

Henry Wyman was re-elected a director of the Carnegie Metals Co. at the annual meeting held in Pittsburgh, Pa., June 8.

Paul Billingsley, chief geologist of the International Smelting Co., has returned to Salt Lake after several weeks' work in southern Nevada.

Felix McDonald, superintendent of mines of the Inspiration Consolidated Copper Co., has left for a tour of England and the Continent with his family.

John V. N. Reynders, who has been in Russia for several months in connection with the American-Caucasian manganese ore concession, expects to return to New York on July 2.

Dr. D. C. Barton, of Houston, Tex., chief geologist of Rycade Oil Co., is giving a two weeks' course of lectures to the students of the school of geology, Chicago University.

Paul Selby, the manager of the Ferreira Deep mine, Johannesburg, South Africa, recently underwent an operation for appendicitis. He is now well on the road to recovery.

Alfred G. Burrows, Provincial Geologist of Ontario, is on his way to the Red Lake area of northern Ontario, to make a study of the geological conditions of the region.

Hans Lundberg, of the Swedish American Prospecting Corporation, is on his way to Rouyn, Quebec, where he will be engaged in electrical prospecting, for the summer months.

W. T. Lee, of the Geologic Branch of the U. S. Geological Survey, has left Washington for Clifton Forge, Va., to advise the city officials regarding the site for a new dam which the city proposes to build.

James O. Handy, director of chemical and metallurgical investigations of the Pittsburgh Testing Laboratory, Pittsburgh, Pa., is inspecting mining properties at Wahnipatae Lake, Ontario, in which he is interested.

Eric Davies, chief mechanical engineer and assistant superintendent of the St. John del Rey mine, Morro Velho, Minas Geraes, Brazil, is in the United States studying problems of mine ventilation and related technical subjects.

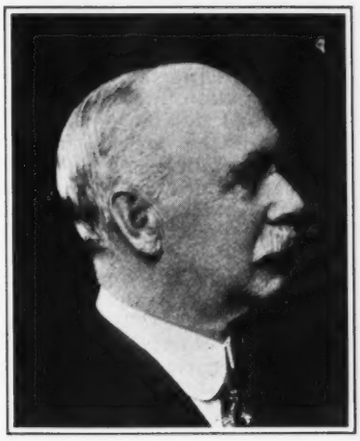
L. O. Howard, dean of the School of Mines and Geology, State College of Washington, was called to the east last month by the death of his father, M. A. Howard, Webster, Mass.

A. I. Walton, manager of the Crown Mines, accompanied by Mrs. Walton and their son and daughter, left Johannesburg on April 29 on a visit to the Victoria Falls, after which they will sail from Beira for Europe and England, via the East Coast route.

R. H. Sargent, of the Alaskan Branch of the U. S. Bureau of Mines, reached Ketchikan, Alaska, June 10 and joined the naval expedition which will make aerial surveys in southeastern Alaska. He wires that the weather is favorable and the planes are already in the air.

Thomas S. Carnahan, assistant general manager of the Union Minière du Haut-Katanga, Africa, is visiting friends and relatives at Salt Lake City and Ogden, Utah, and renewing acquaintances made while a member of the Utah Copper Co. engineering staff.

Julius C. Gunter, mining engineer and former Governor of Colorado, and



David William Brunton

David William Brunton, also a mining engineer and past president of the A. I. M. E., were on June 14 awarded honorary degrees by the University of Colorado. Ex-Governor Gunter received the degree of doctor of laws and Mr. Brunton that of doctor of science.

R. H. Stevens, who went from the United States as metallurgist to the Electrolytic Zinc Co. of Australia, Ltd., and who visited South Africa last year as metallurgist to the Broken Hill Rhodesia Development Co., has been appointed general manager of that company. **Bertram Wood,** who was the electrical engineer for the Electrolytic Zinc Co., has also gone to Rhodesia to superintend the erection of the company's hydro-electric plant.

Obituary

Nicolas du Plessis, who died on May 9, aged sixty-seven, was a Rand pioneer. He was (with the brothers Baartman) one of the discoverers of the Blue Sky, Agnes Munro, and Cinderella gold reefs, which are now included in the East Rand Proprietary Mines, Ltd.

E. Laurie, one of the pioneers of the Jägersfontein diamond mine (O.F.S.) and for many years engineer there, died on May 6 at Grasmere, Transvaal. He was a native of Cornwall and was highly respected for his genial personality. He was sixty-three years old.

Professor A. Mica Smith, who for forty-two years was lecturer in chemistry and metallurgy at the Ballarat School of Mines, one of the best-known institutions of its kind in Australia, died recently at the age of eighty-one. Last year a bust of Professor Smith was presented to the school by old students now living in Western Australia and a memorial scholarship was also established.

Willis T. Lee, geologist, who had been on the staff of the U. S. Geological Survey since 1902, died on June 16. Mr. Lee was born in 1864. He was educated at Wesleyan University, Chicago University, and Johns Hopkins. He taught his specialty in several schools and colleges before joining the Survey, and lectured at Yale. He also wrote extensively on geology, and was a member of many scientific societies and of the Cosmos Club, of Washington, D. C.

Andrew Stuart Johnson, owner of the Johnson Asbestos Co., of Thetford Mines, Quebec, died at his home in Thetford Mines on June 14, in his seventy-sixth year. It was while "cruising" through the forest in the county of Megantic in 1875 that he discovered the asbestos deposits which were to bring fame to the province of Quebec and profit to himself and many others. Mr. Johnson made a success of his mining enterprises, which, however, were not won without difficulties and obstacles that required much patience and perseverence. He was considered to be an outstanding figure in the asbestos world and a miner who knew every detail of the business no matter how small.

Mart A. Howard, who died at Webster Mass., April 29, was one of the pioneers of the Klondike rush. In January, 1898, he crossed Chilkoot Pass in the face of almost insuperable difficulties, taking with him the first animal to go over the pass, an ox used to freight his supplies. Arriving at the mouth of the Stewart River, he and his partner started up the stream in a hopeless quest for another Eldorado, dragging their boats many weary days, while wading in the stream. After spending the summer prospecting in the Macquiaten, Clear Creek, and Nelson Creek country he went on to Dawson and down the Yukon, returning to Seattle for the winter. The following spring, with a partner, he took a supply of merchandise over the White Pass, built a scow on Lake Labarge and was the first arrival by scow at Dawson in 1899. With the proceeds of the merchandise a controlling interest in a claim on Gold Hill was taken. With six men on rockers they washed out $1,000 to $1,500 a day for several weeks, later acquiring other ground on Gold Hill and on Chechako Hill, with successful results. When the Yukon Gold Co. was organized, the last interests of the partnership in the vicinity of 52 Below, on Bonanza, were acquired by that company. For the last eighteen years Mr. Howard lived at Webster, Mass., in enjoyment of the returns of his Yukon days. He was seventy-one at the time of his death.

Recent Technical Publications

Reviews, Abstracts, and References

The Petrology of the Igneous Rocks. By F. H. Hatch. Eighth Edition, 1926. The Macmillan Co., New York, Price $4.75.

As a simplified, clear textbook for the student of petrology, this is an excellent volume. Brevity and clarity, excellent systematization, and abundance of definite examples and illustrations, make the book such that it can be recommended. It is not designed for the beginner in geology, but for the more advanced student who is giving time and study to the specialty of petrology. Principles and classification are touched upon with the right emphasis and balance. The book is comprehensive and conservative, and might well form part of the library of the professional geologist. Examples are drawn almost entirely from Great Britain, which is the wisest and most useful method, because they are personally familiar to the author. A great deal of confusion and error has resulted from widespread correlation of occurrences, in countries with which the writer of a book or an essay is unfamiliar. J. E. SPURR.

Year Book of the American Bureau of Metal Statistics. 1925. Published by the American Bureau of Metal Statistics, 115 Broadway, New York City. Price $2.

The issue of this compilation of the statistics of production, consumption, and commercial movements of the major non-ferrous metals in the principal countries of the world, covering the year 1925, appears promptly, as usual. It is a summary of, and supplementary to, the frequent bulletins issued by the same organization during the year, and for which a considerably greater subscription fee is charged. The field covered is practically the same as in the last edition, and the job has been well done; in fact, the information given is so reliable and complete that the book is perhaps the most frequently referred to of any publication giving metal statistics. Would it not be well to make it even more valuable by including, in future editions, statistics on the world production and price of antimony, platinum, nickel, and quicksilver?

The New International Year Book for 1925. Edited by Herbert Treadwell Wade. Dodd, Mead & Co., New York. Price $6.75.

The 1925 issue of this encyclopedic year book is the twenty-fourth annual volume and covers the same ground as have previous issues. In its 772 pages, reference is made to almost every field of human activity, recording the progress made during the last year, all the more important articles having been prepared by specialists in the fields covered, as is the practice with the Encyclopedia Britannica and other authoritative works. The arrangement is alphabetical, with numerous cross-references. Information can be found on practically every topic found in the usual small encyclopedia.

Canadian Publications

The Mines Branch of the Canadian Department of Mines, Ottawa, Ont., has recently issued two bulletins, Nos. 642, pp. 118, and 643, pp. 115, either of which may be obtained on request. Bulletin No. 642, "Investigations of Mineral Resources and the Mining Industry, 1924," contains the following papers: "A Review of Fifteen Years' Progress in the Production of Non-metallic Minerals in Canada"; "Titaniferous Magnetite Deposits of Bourget Township, Chicoutimi District, Quebec," by A. H. A. Robinson; "The Goldfields of Western Quebec," by W. B. Timm and A. H. A. Robinson; "Magnesium Sulphate in British Columbia," by M. F. Goudge; "Sodium Carbonate in British Columbia," by M. F. Goudge; and "Natural Gas and Petroleum in Northern Alberta," by R. T. Elworthy.

In Bulletin 643, "Investigations in Ore Dressing and Metallurgy," are general reviews of the work in the ore dressing and metallurgical laboratory, the hydrometallurgical laboratory, and the chemical laboratory; and a paper on "The Concentration of Lead-zinc Ores of Eastern Canada," by C. S. Parsons; and one on "The Concentration of the Lake George Antimony Ores," also by Mr. Parsons.

Part 7 of the thirty-fourth annual report of the Ontario Department of Mines, pp. 56, describes the "Geology and Economic Possibilities of Sutton Lake Area, District of Patricia," by J. E. Hawley. The district here reported on, which is west of the northern part of James Bay, was investigated by the Nipissing company as a possible source of silver and of iron ore, but no commercial deposits of either were found. Geological conditions, however, were favorable. Copies of the report are available upon request to the Department at Toronto.

The May 21st issue of the *Canadian Mining Journal* (Gardenvale, Que.; price 15c.) is devoted largely to the Kirkland Lake district and is an excellent guide to present conditions in that region, and gives the production to date of the various mines.

Canadian Geological Survey — The Canadian Geological Survey, Ottawa, Ont., has recently issued three bulletins. Economic Geology Series No. 1 is entitled "Geology and Economic Minerals of Canada," by G. A. Young. (Pp. 240; price 50c.) It is a brief résumé of more detailed publications on the subject, designed for those wishing to make a general study of the economic minerals of the dominion and the geological conditions under which they occur. A large map is appended on which mineral occurrences are indicated, descriptions of each being given in accompanying text.

Memoir No. 144, by F. J. Alcock, pp. 75, price 20c., is descriptive of the "Mount Albert Map-area, Quebec," this district being in the Gaspe peninsula, and having attained some importance on account of zinc-lead discoveries made therein. A geological contour may is appended, including the area in which the Federal mine is situated.

The "Michipicoten Iron Ranges" are discussed in Memoir No. 147 (pp. 175; price 30c.). This has been prepared by W. H. Collins, T. T. Quirke, and Ellis Thomson. The district is a large one, and favorable for prospecting. Some deposits of siderite, in the Helen and Magpie mines, have been mined in the past, and a little gold has been found in the Goudreau area. Geological maps of the Michipicoten area and the Missanaibi area are included.

British Columbia Mining — The annual report of the British Columbia Minister of Mines, for 1925, pp. 466, is now available on request from the Minister of Mines, Victoria, B. C. A large amount of detailed information concerning the geology and development of mining prospects and operating mines is given, coal properties being included. Several sketch maps and photographs are reproduced, together with a colored map of the province. Intending investors might be glad to have more financial data on the properties whose technical operations are so thoroughly covered, though such information can probably be obtained on inquiry to the British Columbia Chamber of Mines, Vancouver, B. C. This organization maintains a list of undeveloped properties looking for financial assistance, with such data as are available concerning them.

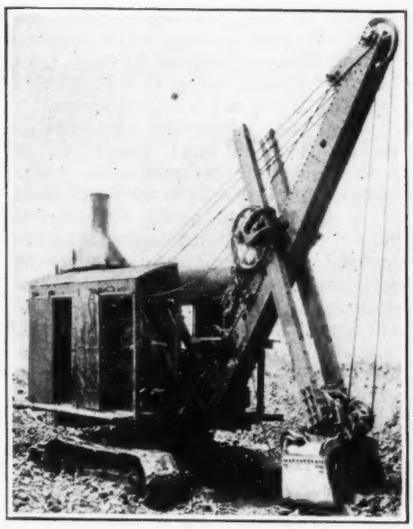
"The Early History of the Fraser River Mines," Memoir No. VI of the Archives of British Columbia, which has just been issued, tells by a series of letters that passed between the Governor of the Colony, the Colonial Secretary, the Attorney General, judges and gold commissioners, of the rush to the Cariboo gold diggings and the means employed to maintain law and order during the rapid influx of twenty or thirty thousand miners and camp followers. The correspondence has been annotated by Frederic W. Howay, who also has provided an exceedingly interesting introduction.

Asiatic Russia—The China Institution of Mining and Metallurgy, Grand Hotel des Wagons Lits, Peking, China, has recently issued a "Bibliography of the Mines and Minerals of Asiatic Russia," by E. E. Ahnert, pp. 34, presumably obtainable on request.

Zinc—"Zinc in 1924," (Smelter Report) pp. 20, has recently been issued by the U. S. Bureau of Mines, in its "Mineral Resources" series. The bulletin is largely confined to economic statistics. Copies are obtainable for 5c. each from the Superintendent of Documents, Washington, D. C. C. E. Siebenthal and A. Stoll are the authors.

Mineral Resources—Recently issued separate chapters of "Mineral Resources in 1924," published by the U. S. Bureau of Mines, include: "Iron Ore, Pig Iron, and Steel," pp. 36, by Ernest F. Burchard and Hubert W. Davis; "Gold, Silver, Copper, Lead, and Zinc in Montana," pp. 31, by C. N. Gerry; and "Copper," pp. 51, by Helena M. Meyer. The first two are obtainable for 5c. each from the Superintendent of Documents, Washington, D. C.; the one on copper can be had for 10c.

New Machinery and Inventions



This one-yard shovel is intended for general use

New One-Yard Shovel Announced

The Bucyrus Company, of South Milwaukee, Wis., has recently announced a new steam shovel, the 31-B. It is a one-yard full-revolving shovel for contractors and general use.

Speaking of this new shovel, G. A. Morison, vice-president and secretary of the company, says: "Close contact with shovel users in the field has shown that the excavating tool most in demand today is a one-yard shovel with very definite qualities. Accordingly, we have built the 31-B to meet these conditions. The over-all dimensions of the shovel are no greater than those of most ¾-yard shovels built today, but this new shovel is a real one-yard shovel, built from caterpillar track to boom sheave for work with a one-yard dipper. Thus built, the clearances of the shovel are such that it can maneuver in and out of odd corners handily and work to advantage in extremely narrow cuts. The rear end radius is just 9 ft. 6 in.

The machine is built to cut a wide level floor 16 ft. 7 in., dig 4 ft. 11 in. below grade, and dump 12 ft. 6 in. above the floor level either to spoil or in trucks. It has abundant strength and power. All Bucyrus features are retained in the design, which, it is said, has been worked out in close co-operation with men in the field, including the outside dipper handle, the box girder boom, two-part hoist direct-connected to dipper, unobstructed dipper opening, swing engine mounted in front and the Bucyrus caterpillars with big idlers and bearings high out of the mud and the continuous treads with no gaps between links.

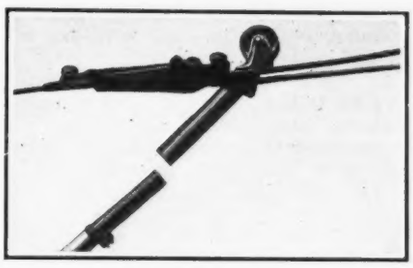
The shovel is also available as a high-lift shovel of one-yard capacity dumping 18 ft. above the floor. and extra high lift, ¾-yard dipper, that reaches its extreme dumping height of 21 ft. 7 in. It is quickly and easily convertible to a dragline, with a 40-ft. boom. It is also offered as a sewer excavator, clamshell or crane.

Pull Releases Wheel Without Breaking Pole

Broken trolley poles are a source of danger and delay. When a wheel comes off the wire, it may not only catch in a frog and tear down the wire, but break the trolley pole also. A safety pole-head designed to prevent the breaking of the trolley pole in case it comes off of the wire and catches in a frog or the like is now available.

This pole-head, sold by the C. & S. Pole-Head Co., Keystone, W. Va., is shown in the accompanying illustration. It consists of a socket to which the harp is attached, and a tapered pole end to which the cable is connected. The socket slips over the pole end and is held firmly but not tightly by a spring clip. A sharp blow or a heavy pull will cause the socket and its wheel to fall free of the rest of the pole.

In case the wheel leaves the trolley wire and catches in something before the motorman can pull the pole down, the socket and wheel are jerked off the end of the pole and fall to the ground. After the trip is brought to a stop, the socket and wheel are retrieved and slipped back into position on the end of the pole. The long delay



Pole pulled apart shows details

caused by the insertion of a new pole is entirely avoided.

The poles have been used on the 30-ton locomotive of a large mining company and the safety feature has operated several times most satisfactorily.

Shifts Track With Rails Level

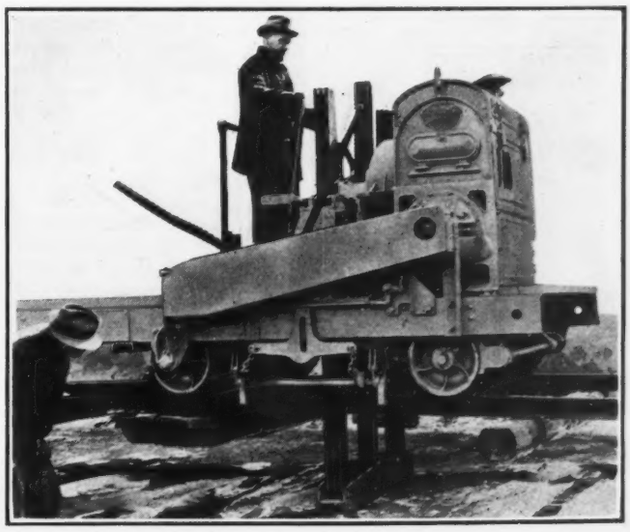
Ordinarily, raising track when ballasting requires the use of track jacks and a large jack crew. To facilitate rapid raising of track and keeping the rails level during the process of raising, a leveling device has been developed for the Nordberg track shifter built by the Nordberg Manufacturing Co., of Milwaukee, Wis.

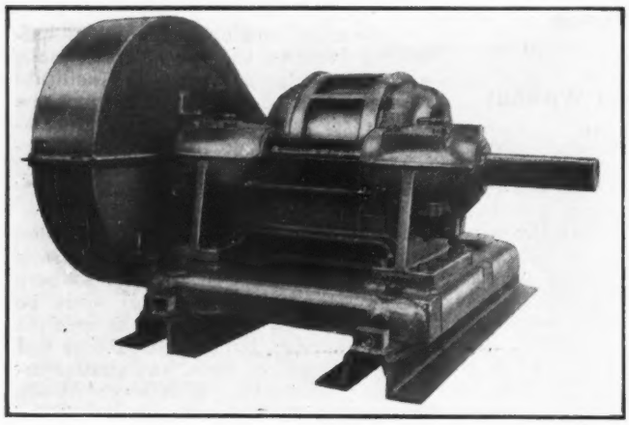
The standard machine was designed primarily to shift or move over track as is often required in operations where large quantities of material must be moved, such as is the case in open-pit mines, quarries, building up dumps and fills, construction work, and similar industrial operations. It is also suitable for raising track for rough ballasting where it is not so important that both rails be raised level or great accuracy be maintained in leveling the track after it is raised. For this service the track shifter will permit of a track crew of four or five men instead of fifteen or twenty as is ordinarily necessary, and eliminates the use of track jacks and aligning bars.

With the single spud, with which the machine is customarily supplied, the difficulty of maintaining a level track, as when ballasting is being done, is apparent. To raise the track level, a device has been perfected which can be applied to any machine already in the field, making the track shifter suitable for shifting or raising track where close accuracy is necessary.

This device consists of a wider footpiece taking the place of the one ordinarily furnished. To the end of this footpiece are attached the two leveling spuds. The lifting action is supplied from the worm-driven spud attached to the center of the footpiece. As pressure is exerted downward and the spud begins to lift the track section and the machine which is clamped to it, the operator by means of two clamp levers controls the vertical movement of the leveling spuds and the amount of lift given to either rail. With this device it is possible to raise the track level and when desired height is reached hold it in this position until the ballast has been shoveled in and tamped. The raising is done slowly and gradually without probability of damage to the track. It is accomplished without the

With this machine the track may be shifted over or raised vertically as desired, with the rails kept level





In this installation motor and reduction gear are mounted on same bed plate

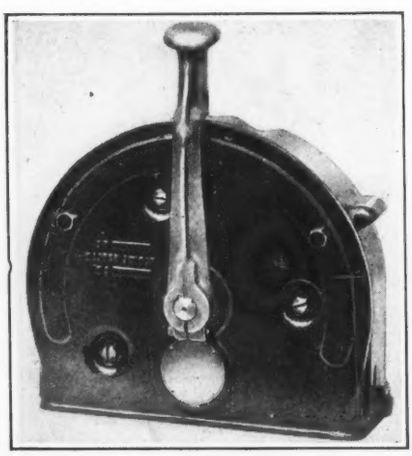
use of track jacks and the inconvenience which they cause when shoveling in ballast. Since jack men are not required, this device is also an important item in reducing ballasting expense. With this device it is possible to raise the track about 2 ft. each lift.

The track shifter is a self-contained, self-propelled unit consisting of a steel-framed car on which is mounted a 40-hp., four-cylinder motor and the necessary mechanism for supplying the lifting action.

Lever-Thrown Master Switch

A lever-operated master switch for installation where exceptional strength and durability are important factors has recently been announced by the General Electric Co., of Schenectady, N. Y. The new switch is particularly suitable for grouping and for operation by one man.

This master switch is flat and semi-circular in general shape, consisting of a cast-iron frame and cover totally inclosing the contact mechanism. This design readily permits convenient grouping within easy reach of one operator. The handle is of the vertical type, operating through a radius of 40 deg. on a one-point switch and through a 100-deg. total radius on switches of the three-point type. This handle is mushroom-shaped so that it may be grasped easily and quickly. Operation from one position to another is quite free, there being no gears or other friction surfaces other than the bearings and contact fingers. The handle is held in the "off" position by a spring roller device.



Switch affords safety from shock

Motor and Reduction Gear Mounted on Same Bed Plate

A back-gear attachment designed to operate under the most unfavorable conditions is announced by the General Electric Co. for use with its "500 series" induction motors. This attachment is of unusually strong construction and is easily installed and adjusted.

The base, to which the motor and back shaft pedestals are bolted and doweled, is a single, large casting. A special unit-type pedestal is used, one casting forming the housing for the large back-shaft bearings. Thus maximum rigidity and permanent, correct alignment of shafts, and meshing of gear and pinion, are assured.

The back shaft is provided with shoulders to limit end play and is made of special steel. It is supported by two extra large, double-seated, split bearings in dust-proof housings, holding oil sufficient for a number of months' operation.

A split gear case, fabricated from steel plates, protects the gear and pinion from dust and retains the grease or oil in which the gear runs. Two standard gear ratios are available. Steel or fabroil pinions with cast-iron gears may be used. Two box-type welded rails with an easy adjusting feature complete the equipment.

Static Condenser Designed for Individual Motors

Development of a line of static condensers for application to 220-, 440-, and 550-volts two- and three-phase individual motor circuits has been announced by the Westinghouse Electric & Mfg. Co., of East Pittsburgh, Pa. The new condenser consists of insulation inclosed in a sheet-metal container and a porcelain terminal housing arranged for conduit connections.

By the corrective effect at the motor that these condensers afford many advantages are said to be obtained: The losses are less than ½ per cent regardless of the kilovolt-ampere rating; the power factor is corrected immediately; because of the reduction of the line current the voltage regulation at the motor or on the feeders is improved; the power-factor correction is flexible and applied where needed. There are other advantages but these are the most outstanding.

Bakelite Instrument Parts Facilitate Surveying

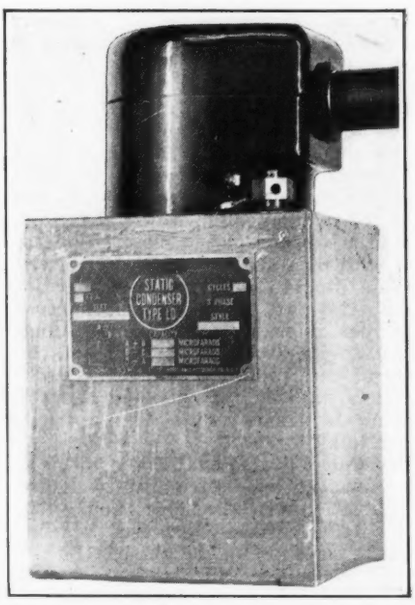
Since surveying necessitates constant use of instruments, surveyors employed in either very cold or very warm regions are often inconvenienced by the temperature of the metal parts which must be handled in the use of instruments of the ordinary kind. Various non-metallic materials were at first suggested to take the place of the customary brass adjustment parts on instruments that were to be used in arctic or tropical regions. At this point manufacturers discovered the economic advantages of bakelite resin, made from phenol and formaldehyde. This resin, can be molded by one operation into the shape desired, with threadings, millings, and surface finish complete. Detail hand operations necessary for the manufacture of any other material are thereby eliminated and production costs are reduced. In fact, one firm that manufactures surveying instruments has found that since it has installed molded bakelite thumb nuts, eye pieces, tangent and clamp screw heads, and pinion heads on its instruments it has been able to eliminate from nine to thirty-two manufacturing operations, depending on the individual part produced.

Trade Catalogs

Control Equipment — Bulletin GEA-388 of the General Electric Co. covers Type MT control equipment for d.c. series-wound crane bridge and trolley motors.

Diesels—Bulletin 707 of the Foos Gas Engine Co., Springfield, Ohio, describes the Type L Foos Diesel. This is a four-cycle full-Diesel burning cheap fuel oil. Hp. 50 to 475.

Gears — "Gear Problems and IXL Speed Reducers" is the title of a 621-page catalog and handbook issued by Foote Bros. Gear & Machine Co., Chicago (Catalog No. 200). It is said to be a complete reference book on the design and application of modern speed-reduction units and industrial gearing.



New condenser corrects power factor

The Market Report

Metal Markets Quiet and Prices Easier

Volume of Buying Slackens—Copper Back to 13.925c.—Scant Premium on Lead in Outside Market

New York, June 23, 1926.—With the exception of tin, recessions in prices in London occurred in all the major nonferrous metals during the week ending today, and these were matched in the domestic market. Tin was rather active yesterday afternoon, and a net increase in the price is noted. The leading interests have not changed their price for lead, but premium prices that prevailed a week ago are no longer in evidence in New York, even for prompt shipment.

Copper Especially Dull

The tonnage of copper that changed hands during the week ending today is less than for any week since early in May. With one or two exceptions producers have no metal for July shipment, and they are maintaining an asking price of 14c. delivered in the East. However, there has been no business at 14c. except two small sales since Monday, whereas a fair tonnage brought 13.95c. and one round lot was placed at 13.90c. With the exception of one large brass founder, who bought for August delivery, buyers have confined their purchases to July. Sellers look for a good business for the August position to develop soon. Export trade is fair, with 14.15c., c.i.f., and 14.90c., f.a.s., the average figures for the week.

Daily Prices of Metals

June	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	13.75	59.50	61.625	8.275	8.15	7.10@7.20
18	13.725	59.00	61.375	8.275	8.125	7.10@7.125
19	13.725	58.75	61.125	8.25	8.125	7.10@7.125
21	13.70	58.75	61.125	8.25	8.10	7.10@7.125
22	13.70	59.00	61.50	8.25	8.10	7.10@7.125
23	13.675	59.625	62.00	8.25	8.10	7.175
Av.	13.713	59.104	61.458	8.258	8.117	7.129

The prices correspond to the following quotations for copper delivered: June 17th, 14.0c.; 18th and 19th, 13.975c.; 21st and 22nd, 13.95c.; and 23rd, 13.925c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
17	57 1/8	58	65	271 3/8	271 1/4	31	31 1/8	33 3/4	33 9/16
18	57	57 3/4	65	271 1/2	271	30 7/16	30 1/2	33 7/16	33 3/8
21	57 1/8	58	65	270 3/4	270 1/4	30 1/4	30 1/4	33 1/8	33 3/16
22	57	57 7/8	65	271	270 1/2	29 11/16	29 3/4	33 1/16	33 3/16
23	56 7/8	57 3/4	64 3/4	273 3/4	273 1/4	30 1/16	30 3/16	33 7/16	33 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.86	66 1/4	30 9/16	84s11 1/2d	21	4.86	65 3/4	30 7/16	84s11 1/2d
18	4.86	65 7/8	30 7/16	84s11 1/2d	22	4.86 1/8	65 5/8	30 5/16	84s10 1/4d
19	4.86	65 7/8	30 7/16	.....	23	4.86	65 3/8	30 3/16	84s10 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Little Change in Zinc Prices

Since Thursday business in zinc has been done at 7.10c. and 7.125c. per pound for Prime Western in St. Louis. With London a little firmer today, the price has stiffened, and 7.175c. has been done. The price of concentrate in St. Louis was advanced to $48, due to some curtailment in production and better demand from smelters. The statistics for world production in May showed a modest decline in the rate of output, which is interpreted as a bullish factor. High-Grade continues at 8.50c. per pound delivered in New York.

Demand for Lead Subsides

Last Thursday was an unusually active day for lead, consumers apparently being anxious to buy before the Smelting company made another advance. The tendency in London, however, has been downward until today, so that much of the apprehension concerning price increases in the domestic market has been removed. Business has fallen away to a considerable extent; in the last day or two it has been below normal. Most of the inquiry has been for either prompt or July shipment, and as several sellers are practically sold out of lead for early delivery, some potential buyers have had to make several bids to get their orders placed. A small amount of August-September lead has been sold, but producers are in general unwilling to quote so far ahead.

The contract price of the American Smelting & Refining Co. continues at 8.25c., New York, and the outside market for prompt carloads has receded to about the same level. Practically all the business in the Middle West has been at either 8.10 or 8.15c., St. Louis basis, with a fair tonnage sold at 8.25c., Chicago. The usual premium on corroding grades is $2@$3 per ton.

Tin More Active

The tin market has been generally quiet, though much more interest has been exhibited since yesterday noon, and the price on prompt Straits has advanced to 62c. Consumers and traders have both entered the market and taken a fair tonnage, particularly for July

and August delivery. Forward prices are up to 1½c. less than prompt. The 99 per cent grade has sold somewhat more freely.

Foreign Exchange Quiet

The principal foreign exchanges were quiet yesterday, with closing cable quotations as follows: francs, 2.8425c.; lire, 3.6175c.; and marks, 23.81c. Canadian dollars, 9/64 per cent premium.

Silver Market Quiet

During the early part of the last week the demand for silver from India and China forced prices up and the New York quotation reached 66¼c., which was the highest level for over three months. The improvement did not last long, however, for the bazaars turned sellers abroad, with the result that prices dropped nearly one cent in a week. The market closes quiet without tendency.

Mexican Dollars (Old Mexican Pesos): June 17th, 50⅝c.; 18th and 19th, 50½c.; 21st, 50⅜c.; 22d, 50¼c.; 23d, 50⅛c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 per long ton. Market in Britain dull; German production equal to consumption.

Antimony—Per pound, duty paid, New York: Chinese brands, spot, 10⅞@12c. July arrival, 10⅞@12⅛c. Cookson's "C" grade, spot, 20⅝c. Market dull and prices mostly nominal with some buying by speculative interests.

Bismuth—$2.70@$2.75 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. Market good. **London, 1s. 9d. for Australian metal.**

Iridium — $125@$135 per oz. for **98@99 per cent. Nominal. London,** £63@£65 for 99.5 per cent.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent). London, £170@£175 per long ton.

Osmium—$75@$80 per oz., nominal; London, £17@£20.

Palladium—Refined, $70@$72 per oz. As a constituent of crude platinum, $60@$65 per oz. London, £12@£15, nominal.

Platinum — Per ounce refined, officially quoted: $112@$114. Sales also at $108@$112. Crude, $109. London, £22@£23½ for refined; crude, £21.

The official price of refined platinum was raised to $112 on June 17, and to $114 on June 21.

Quicksilver—Per 75-lb. flask holding steady at $91@$92. San Francisco, $90.67. London, £15.

Ruthenium — $75@$80 per oz.; London, £12@£15.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of June 5.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $10.50@$10.60; Western scheelite, $10.75@$10.85. Some consuming demand for the first time in many weeks.

Vanadium Ore—Containing 4 to 8 per cent V_2O_5, 30@35c. per pound of V_2O_5 f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent V_2O_5, 60@65c. per pound V_2O_5, duty paid, seaboard.

Chrome Ore, Iron Ore, Manganese Ore, Molybdenum, Tantalum, and Uranium are unchanged from quotations in the June 5 issue.

Lead Ore $5 Higher Zinc Blende Up $1

Joplin, Mo., June 19, 1926

Zinc Blende	Ton
High	$51.60
Premium blende, basis 60 per cent zinc	$49.00@50.00
Prime Western, basis 60 per cent zinc	48.00
Fines and slimes, 60 per cent zinc	47.00@44.00
Average settling price, all zinc	46.18
Galena	
High	$99.70
Basis 80 per cent lead	100.00
Average settling price, all lead	97.10

Shipments for the week: Blende, 13,454; lead, 1,268 tons. Value, all ores the week, $745,460.

One large producing company disposed of 2,000 tons, sold late last Saturday, on $48 basis, which set the basis price for this week, and the tonnage purchased this week on $47 basis was quite small, several buyers lowering offerings today to that figure. The shipment is less than the sales of last week, buyers leaving a purchased tonnage in the bins. Production has slightly increased, advancing to about a parity with shipments.

Sellers are parting with their lead slowly, believing a higher basis price is warranted on the quotations of metal and the outlook ahead. The shipment was the lowest of the year, with one exception, the week of May 22. The advance to $100 basis this week may bring more of this mineral on the market. There are producers who think this price insufficient.

Platteville, Wis., June 19, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$49.75
Lead Ore	
Lead, basis 80 per cent lead	$100.00

Shipments for the week: Blende, 1,137 tons; lead, none. Shipments for the year: Blende, 25,279; lead, 672 tons. Shipments for the week to separating plants, 1,844 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the June 5 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3½c. per lb. Occasional carlots sold. London, £14 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and Zinc Oxide are unchanged from prices in the June 5 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton, furnace; prompt and future.

Ferrosilicon—14 to 16 per cent, $42 @$47 per gross ton, f.o.b. works; 50 per cent, $85 delivered in carload lots; 75 per cent, $145. Market good.

Ferrotungsten—$1@$1.05 per pound contained W, f.o.b. works according to grade.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrotitanium, Ferrouranium, Ferrovanadium, and Spiegeleisen are unchanged from prices in the June 5 issue.

Metal Products

Rolled Copper — Sheets, 22½c.; wire, base price, 16c. per lb.

Zinc Sheets — 11.25c. per lb., f.o.b. works.

Lead Sheets, Nickel Silver, and Yellow Metal are unchanged from prices in the June 5 issue.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the June 5 issue.

Market for Steel, Pig Iron and Coke Quiet

Pittsburgh, June 22, 1926

Steel ingot production in 1925 was 44,140,738 gross tons, making a new record by passing 1917 by 1.2 per cent. Steel castings fell far short of making a new record, and except for 1921 and 1924 the production of rolled iron was the smallest since the Civil War. Relatively light production of foundry and malleable pig iron shows that the iron foundries did not do well. In other words, production of steel ingots, and the rolled steel made from them, is not indicative of conditions in other branches of the general iron and steel industry. This year will in all probability make a fresh record in steel ingots and rolled steel, but the iron and steel foundries and the iron mills are by no means busy, nor, in turn, are the merchant blast furnaces.

Steel-mill operations will probably average fully 80 per cent this month, whereby successive 4 per cent losses would be shown from the 92 per cent operation of March. Though there may be no upturn later in the year, operations are holding up much better for the summer than they did last year.

Steel bookings increased in May over the April record, and this month may do still better, but this is partly technical, old business running out and being replaced by fresh obligations. Consumption in general is simply decreasing slightly.

Pig Iron — The Valley - Pittsburgh market remains stagnant. Sales of Lake-front furnaces have increased. Bessemer, $19; basic, malleable, and foundry, $18, f.o.b. Valley furnaces.

Connellsville Coke — There is very little contracting. Spot furnace, $2.75 @$2.90; spot foundry, $4@$4.50 for standard.

Company Reports

Homestake Gross Income $6,000,000

Operations at the mine and mills of the Homestake Mining Co., producer of gold in South Dakota, were continuous and satisfactory throughout the year 1925 according to the report of B. C. Yates, superintendent. During the year proceeds were $5,999,073 from 1,589,701 tons of ore milled, or $3.77371 per ton. There were 639,982 tons of ore broken down and remaining in the stopes and 15,448,319 tons of ore blocked out and remaining in the mine on Dec. 31, 1925.

Revenues

Bullion	
Proceeds of bars 6296-6517	$5,999,073.56
Discount and interest	77,541.16
Rents	2,883.60
	$6,079,498.32

Operating Expenses, Year 1925

Mine account	$2,127,101.30
Development	18,088.12
B. & M. shaft	217,689.84
Ellison shaft	195,376.89
Old brig shaft	3,475.30
Tramway	59,554.99
Amicus mill	139,582.41
Golden Star mill	7,055.53
Monroe mill	34,596.12
Pocahontas mill	69,410.05
South Mill operation	153,009.43
Terraville ball-mill operation	17,410.01
Cyanide No. 1	110,441.58
Cyanide No. 2	50,435.98
Slimes	140,610.54
Debris	750.58
Freight on bullion	15,607.63
Wolframite ore operation	6,667.05
Aid fund	1,993.25
Benefices	8,640.01
Pensions	37,204.17
Workmen's compensation	22,041.14
Personal injuries	300.00
Hospital	55,737.56
Recreation hall operation	28,133.42
General expense	133,260.40
Office	23,453.64
Salaries	24,000.00
House expense	9,336.33
Legal expense	14,403.29
Insurance	14,976.05
Taxes	404,380.00
Golden Gate M. & T. operation	29,214.88
Wyodak C. & M. operation	11,375.70
Depreciation	740,361.22
Depletion	589,871.41
Dividends	$1,758,120.00
Less amount paid from depletion reserve	1,194,167.56 563,952.44
	$6,079,498.32

Balance Sheet as Jan. 1, 1926

Assets

Plant	$29,483,767.01	
Less depreciation and depletion	8,523,666.08	$20,960,100.93
Balance in bank		1,010,934.09
Balance with superintendent		46,619.32
Bullion in transit		334,143.94
U. S. Government bonds, $1,525,000 par value		1,528,171.88
Accounts receivable		1,317.68
General supplies, as per inventory Jan. 1, 1926		533,383.31
Profit-and-loss account		981,519.18
		$25,396,190.33

Liabilities

Capital stock—	
251,160 shares @ $100	$25,116,000.00
Outstanding drafts	201,065.73
Accounts payable	74,023.64
Unclaimed dividends	5,100.96
	$25,396,190.33

Tonopah Extension Mining

Gross earnings of Tonopah Extension Mining Co., mining silver in the Tonopah district in Nevada, for year ended March 31, 1926, were $815,148, comparing with $2,474,304 in previous year. Net income after depreciation, depletion, and other charges was $555,312, against net income of $311,107.

Mansfeld Bonds Sold in United States

Brown Bros. & Co. and Lee, Higginson & Co. have floated in the United States $3,000,000 Mansfeld Mining & Smelting Co. 15-year 7 per cent mortgage gonds, on a basis to yield 7⅜ per cent. The Mansfeld Mining & Smelting Co. is a 725-year-old German copper mining, smelting, and refining company. The bonds carry detachable warrants, exercisable after Jan. 1 next, entitling the holder to purchase, prior to May 1, 1936, 15 shares of common stock of 50 reichmarks par value for each $1,000 bond. The average dividend on the amount of stock now outstanding has been about 9 per cent for the past twenty years and at present is 8 per cent a year. Amsterdamsche Bank has offered $500,000 of the bonds simultaneously in Holland.

The company is one of the largest metallurgical enterprises in Europe, owning and operating copper and silver mines, smelters, copper and brass works, coal mines, electric generating plants, and 87 miles of private railway.

Production last year included 52,540,000 lbs. of refined copper, 2,900,000 oz. of silver, and 5,000,000 lbs. of lead. Copper and brass works produced 26,038 tons of manufactured products; coal output was 2,800,000 tons, with 28,000 tons of byproducts. Net earnings from the various enterprises last year were $1,127,200, or nearly 4.4 times annual interest on entire present funded debt, including the $3,000,000 issue of 7 per cent bonds.

U.V.X. and Union Miniere Buy Interest in Nichols Copper Co.

The sale has been announced of a substantial block, said to be between 40 and 45 per cent of the 70,000 outstanding shares, of the capital stock of the Nichols Copper Co. to the United Verde Extension and Union Minière copper mining companies. At the same time the two mining companies entered into long-term contracts under which their copper will continue to be refined at the Nichols plant, at Laurel Hill, Long Island. Unofficial reports place the interest that changed hands at 20,000 shares to U.V.X. and 10,000 shares to Union Minière.

At a special meeting of board of directors of Nichols Copper Co., James S. Douglas and Archibald Douglas, of the United Verde Extension Mining Co., and Fernan Pisart, managing director of Société Générale de Minerais, of Brussels, were added to the Nichols board. Aside from the election of these directors, there has been no change in the management of the Nichols company, C. W. Nichols continuing as president, Charles Ferry and Julian B. Beaty, vice-presidents, J. A. Church, Jr., secretary, and Walter C. Bennett, treasurer.

Through this sale of stock the Nichols company now has mining interests of considerable importance identified with it. The Nichols Copper Co. has for a number of years refined the entire output of the United Verde Extension and about half of the output of the Union Minière du Haut-Katanga. Because of its greater financial interest in the Nichols Copper Co., members of the trade are inclined to believe that more of Katanga's copper may be sent to the Laurel Hill refinery in the future. At any rate, the new affiliations assure the Nichols company of blister to keep its refinery going at full capacity.

Zinc Position Affected by British Coal Strike

By A. J. M. Sharpe

Honorary Foreign Correspondent of the American Zinc Institute

London, June 1—Although the general strike in Great Britain was settled within the fourteen days predicted as its duration, the coal miners remain adamant. The famine in fuel supplies is handicapping British industries throughout the land, and similarly the public utility companies have found it necessary drastically to ration the consumption of power by their customers. It is scarcely a matter for wonder therefore that the metal industry is badly crippled and that consumption, which was bad enough in May, is likely to be even worse in June unless the coal strike is settled and the miners return to work before the end of the month. At best, the United Kingdom did not consume more than 9,000 tons of zinc last month, and we shall be lucky indeed if the June consumption is anything like that figure. Probably it would not be wise to figure on the consumption for May and June averaging more than 50 per cent of the 28,000 tons which would represent the normal consumption of those two months. Continental smelters are of course feeling the lessened selling outlet for their metal in the British Isles, and had it not been for the nursing of the London market by leading Continental interests by way of market support, the London Metal Exchange quotation would inevitably have suffered badly. As it is, the absence of selling pressure and the incidence of occasional export buying has not only

kept the market steady but has been the means of bringing about a small price advance.

British production of slab zinc in May is estimated at 1,470 tons, but will be purely negligible in June, as those smelters which are working at all are merely keeping their furnaces warm. Concentrates continue to arrive from Australia and are being stored at the smelters against future requirements when full operations are resumed after the coal strike.

Sheet zinc business on the Continent is only fairly satisfactory, and actual results in the brass trade leave much to be desired. German consumption—which, as I have frequently pointed out in the past, is the governing factor in the European zinc situation—is very poor, and, though there is some slight gain each month on the takings by German consumers, such betterment is painfully slow.

As previously mentioned, the safety valve in the world zinc situation is that the cost of production approximates pretty closely to the present selling market. On the other hand, whether zinc be regarded as cheap today or not, the fact remains that no material price advance is warranted. In the interests of the trade, therefore, it would be preferable for slab zinc to hold at its present level until the British coal strike is over and the brighter sentiment then likely paves the way for better things. It is now believed that the output of slab zinc in the United States has been drastically curtailed, although it is unlikely that the full extent will be reflected when the May statistics are published. World stocks of zinc June 1 are estimated as follows:

Country	Metric Tons
United States	27,200
Canada	2,400
Australia (including unsold shipments afloat)	2,200
Germany and Poland	9,000
Belgium	2,800
France	1,200
Great Britain	2,200
Scandinavia	200
Far East	500
Elsewhere	1,500
Total	49,200

Auction Sales of Mining Stocks

The following mining stocks have been sold at auction at New York, Boston, Philadelphia, and Buffalo recently:

5,695 Goldfield Deep Mines Co., par 5c., for the lot $10
2,000 Lorraine Consolidated, per share 0.07
305 El Paso Mining Co., par $5, and other securities, lot 17
40 New Idria Quicksilver Mines, Inc., common, per share 2
2,000 Columbus Kirkland, per share 0.04
1,000 Silver Bar Mining, lot 5
50 Teziutlan Copper Mining & Smelting, and other securities, lot 50
$2,000 Mountain Valley Mining Co., 1st 8's, July 1, 1910, with Oct. 1, 1909, and subsequent coupons attached; 4,000 Mountain Valley Mining, par $1; 50,000 Republic Gold Mines Ltd., par $1; 800 Peerless Mining Co., par $1; and other micellaneous securities, lot 12
500 Cleopatra Mining Co., par $1, and other securities, lot .. 15
1,000 Silver Bar Mining, lot 4.75
50 Mitchell Mining Co., par $10, and other securities, lot 2
$2,500 New England Minerals Co., 1st mortgage s.f. 8's, Oct. 1938, coupon, April, 1926 on, and other securities, lot 15
1,500 Mizpah Extension Co. of Tonopah, lot 10
600 Eden Mining Co., lot 2
2,000 Lorraine Consolidated, per share 0.06
1,000 Night Hawk, par $1, per share 0.06
10,000 Morington Mining, par $1, lot 12
10,000 Boston Goldfield Mining Co., par $1, lot 4
200 Bingham Central Mining Co. certificates of deposit, and other securities, lot 326
1,000 Night Hawk, par $1, per share 0.06
2,000 Lakeside Lorraine, par $1, per share 0.05
1,000 Silver Bar Mining, par $1, lot 7
1,000 Preston East Dome, par $1, per share 0.04
200 McNamara Mining & Milling, 100 Comstock Tunnel, 60 Silver King of Ariz., and others, lot 17
2,000 Carawba Gold Mining, par $1; 3,000 Sun and Moon Mining & Milling, par $1, and others, lot 26
50 Foster Cobalt Mining, par $1; and 5,800 Great Northern Silver Mines, par $1; lot 2
24 Silver Peak Mining of Colorado, par £1; and 100 Mineral Point Tunnel, par $10; and others; lot 6
1,000 Silver Bar Mining, par $1, lot 6
22,000 Gold Hill Consolidated, par $5, lot 1
4,000 Columbus Kirkland, par $1, per share 0.03
215 Silver Fissure Mining, and 1 Yale Leasing Corp., lot 35
6,500 Crown Prince Consolidated Mines; 200 Jumbo Extension Mining; 12 Round Mountain Mining; 1 $500 bond, N. J. Mineral Co., 1st s. f. 6s., 1925 series A; 1 $700 do series B; 25 Beneficial Interests, American Minerals Co., pfd.; 250 do. com.; and others; lot 25
450 Dominion Bessemer Ore Co., pfd.; 600 do. com.; $30,000 do, 1st, s. f. 6s. July, 1910, and subsequent coupons attached, lot 11
10,000 Assets Realizing Mines Corp., lot 100
5,000 Utah Metal & Tunnel, 1st conv. 7s, April, 1929, per share ..... 40 and int.
800 Standard Silver Lead Mining, par $1, lot 44

Mining Dividends Still Increasing; June Total Is $27,500,000

The following dividends were paid by American mining and metallurgical companies in June:

Companies in the United States	Situation	Per Share	Total
American Metal	U. S. and Mex.	$1.00 Q	$593,458
American Metal pfd	U. S. and Mex.	1.75 Q	87,500
American Smelting & Refining pfd.	U. S. and Mex.	1.75 Q	875,000
Bingham Mines, s, l	Utah	1.00 Q	50,000
Butte & Superior Mining, z, s	Mont.	0.50 Q	145,099
Calumet & Arizona, c	Ariz.	1.50 Q	964,135
Calumet & Hecla, c	Mich.	0.50	1,002,751
Eagle Picher Lead, z, l	Okla., Mo., Kans.	0.40 Q	400,000
Federal Mining & Smelting pfd., s, l, z	Ida., Okla.	1.75 Q	210,000
Gladstone Mountain, l	Wash.	0.005 M	6,609
Hecla Mining, l, s	Idaho	0.50 Q	500,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel	Minn.	0.75 Q	887,099
International Nickel, n, c	Ont., W. Va.	0.50 Q	836,692
Isle Royale Copper	Mich.	0.50	75,000
Mohawk Mining, c	Mich.	1.00 Q	115,000
Mother Lode Coalition, c, s	Alaska	0.375 SA	937,500
National Lead	Various	2.00 Q	413,108
National Lead pfd	Various	1.75 Q	426,433
Nevada Consolidated Copper	Nev.	0.25 Q	499,864
St. Joseph Lead	Mo.	0.75 Q	1,452,478
Sidney Mining, s, l, z	Idaho	0.0025 I	3,750
Sloss-Sheffield Steel & Iron	Ala.	1.50 Q	150,000
Tennessee Copper & Chemical	Tenn.	0.25 Q	198,650
Texas Gulf Sulphur	Texas	2.50 Q	1,587,500
Tintic Standard, s, l, c	Utah	0.40 Q	461,166
Tom Reed Gold	Ariz.	0.02 Q	18,191
U. S. Steel	Various	1.75 Q	8,895,294
Utah Copper	Utah	1.25 Q	2,030,612
Companies in other countries			
Chile Copper	Chile	0.625 Q	2,744,528
Hollinger Consolidated Gold	Ont.	0.08 4 wks.	393,600
Lake Shore, g	Ont.	0.10 Q	200,000
McIntyre Porcupine, g	Ont.	0.25 Q	199,500
Mexico Mines of El Oro, g, s	Mex.	ls. 6d.	£15,750
San Francisco Mines of Mexico, l, z, s	Chihuahua	ls. 6d.	120,000
Total			$27,486,097

Q, quarterly; M, monthly; SA, semi-annually; I, initial; s, silver; l, lead; z, zinc; c, copper; g, gold; n, nickel.

The total of mining dividends paid in June of this year is over $4,000,000 greater than was paid in June, 1925, or about 19 per cent. The amount is also about $350,000 greater than was paid for the last corresponding quarter, in March, 1926, Inland Steel raised its quarterly rate from 62½c. to 75c., which, it is presumed, will be continued; and a small mine in the Northwest, the Sidney Mining Co., is reported to have paid a small dividend for the first time. The other regular dividend payers made no change in the amount of their distributions. Calumet & Hecla and Isle Royale, two Michigan copper producers which have been somewhat irregular in their dividend payments, each mailed checks to their stockholders this month.

Dividend Yields

The dividend yields on the stocks of the above companies that are on a regular dividend basis, based on the June distributions and on recent market prices, are as follows:

Company	Per Cent Annual Yield	Company	Per Cent Annual Yield
Butte & Superior	19.3	Nevada Consolidated	7.4
Gladstone Mountain	16.9	St. Joseph Lead	7.2
Mother Lode	12.8	Texas Gulf Sulphur	7.0
Tom Reed Gold	12.3	American Metal pfd	6.1
Tintic Standard	12.3	A. S. & R. pfd	5.9
Mohawk	11.9	National Lead pfd	5.9
Hecla	11.4	Eagle Picher Lead	5.7
Homestake	11.1	International Nickel	5.4
Bingham	11.0	Hollinger	5.3
Federal M. & S. pfd	9.2	U. S. Steel	5.1
Calumet & Arizona	9.0	National Lead	5.0
Tennessee Copper	8.3	Utah Copper	5.0
American Metal	7.5	Sloss-Sheffield	4.6
Inland Steel	7.5	McIntyre Porcupine	3.9
Chile Copper	7.5	Lake Shore	3.5
Average			8.4

The yield on Butte & Superior has advanced somewhat from what it was in March and that stock now leads the list. Investors evidently feel that ore reserves are none too well assured. The yield on Gladstone should increase next month, when the dividend is increased from ½c. a share to 1c. The low yield on the northern Ontario gold stocks, Hollinger, McIntyre, and Lake Shore, is interpreted as indicating that the public is discounting higher dividends which are expected in view of increases in mine and mill capacities, in ore reserves at depth, and, in the case of the first two companies named, in favorable developments in the Rouyn and Red Lake areas.

Current Prices of Mining Supplies

Rise and Fall of the Market

STRUCTURAL steel registered a rise of $2 per ton during the past month, while steel sheet quotations dropped 10c. on blue annealed and black and 20c. per 100 lb. on galvanized. The lumber market is weak, with the possible exception of long-leaf, yellow pine. Linseed oil advanced 2c. in Denver and Chicago and 6c. per 7½-pound gallon at New York, since June 17. Prices of most of the other mining supplies remain fairly steady.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.30@$2.40	$3.60	$3.50	$3.90	$3.89
Black					
No. 28	3.00@ 3.25	4.60	4.10	4.90	4.50
Galvanized					
No. 28	4.20@ 4.40	5.70	5.25	6.00	5.65

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$2.80	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90@4.15	3.90@4.00	4.55	4.40	5.85	3.90
Standard section angle bars	2.75@2.80	2.80	3.40	3.25@3.75	4.00	4.15

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	1.90	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	1.90	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90	2.10	3.34	4.15	3.35	3.10	3.30
Plates	1.90	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60@65%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD	1 to 3	62	50½	1 to 1½	30	13
LAP WELD	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	48%	55%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$51.60@ 53.60	$50.60@ 51.60	$41.00 @ 42.00 base	$49.20@ 50.20	$47.50	$52.00

NUTS—Semi-finished, ⅝x1½-in., 2c. each. Discount 70% for ⅝-in. and smaller; 65% for ¾-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1112	$0.1162	$0.075	$0.12	$0.07	$0.108	.....
6x12x12	.1667	.1743	.096	.....	.094	.156	$0.252*
8x12x12	.2084	.2179	.135	.22	.128	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago Up to 20 Ft., Pine	Chicago Up to 32 Ft., Fir
3x4 to 8x8	$43.00	$44.00	$42.50	$41.00
3x10 to 10x10	50.00	51.00	47.50	41.00
3x12 to 12x12	57.00	58.00	57.50	41.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$51.00	$48.50†	$51.00	$50.50	$60.00	$58.00†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	34.75	34.75	34.75	.....	34.75
Minneapolis	42.00	39.00	35.00	.....	44.00	39.75
Kansas City, Mo.	44.50	40.75	.....	.....	59.50	41.75
Philadelphia	54.00	36.00	38.00	45.00	65.00	36.00

*Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.05	$3.75	$4.25	$2.93	$4.95
Cut	2.80	....	5.00	5.00	3.15	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50	$2.50@2.60
Chicago, f.o.b.	2.10	2.10	2.20
Cleveland, f.o.b.	2.29	2.29	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb.net Common
New York	$18.20	$12.@13.10	$3.50	$2.25@$2.75
Chicago	20.00	18.00	....	2.25

LINSEED OIL—These prices are per gallon:

	New York Currant	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.89½	$1.09	$0.94	$1.23

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	15.75	16.75	17.25
White	15.25	15.75	15.25	15.75

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... 74c per ft.

Air—Best Grade
½-in., per ft. ..... 3 ply $0.37½ 4 ply $0.46

Steam—Discounts from List
First grade ..... 30–10% Second grade ..... 40% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–5%
Heavy	30–10%

RAWHIDE LACING—For cut, best grade, 50%, 2nd grade, 60%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ⅛ in.	$1.05
Rubber sheet	.60
Rubber sheet, wire insertion	.85

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0 30	New Orleans	$0.25½
New York	.26	Seattle	.24
Chicago	24½	San Francisco	.25

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.26	$0.2875
Minneapolis	.191/	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1925

FLOTATION OIL—
Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.45

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. works, per lb.	$0.09@.10
Litharge, f.o.b. New York, kegs, per 100 lb.	15.25
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	18@.22
Calcium carbide, in drums, f.o.b. works, per lb.	05½@.06

Mining Stocks—Week Ended June 19, 1926

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	47⅛	46	47⅛	Ap.17, My.24 0.75
Arcadian Consol.	Boston	*75	*75	*75	
Ariz. Com'l.	Boston	11¼	10	11¼	Jy.21, Jy. 31 SA 0.50
Calaveras	N. Y. Curb	....	....	1⅛	
Calumet & Arizona	New York	14⅞	13⅞	14⅝	Jn. 4, Jn. 21 Q 1.50
Calumet & Hecla	Boston	14⅛	13¾	14⅛	Jn. 1, Jn. 15 Q 0.50
Cerro de Pasco	New York	66⅜	64⅛	65⅛	Ap. 15, My. 1, Q 1.00
Chile Copper	New York	33⅛	32⅝	33	Jn.2, Jn.28, Q 0.62½
Chino	New York	23	23	23	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	3⅛	3	3	
Copper Range	Boston	15¼	14⅛	15	May, 1925 1.00
Crystal Copper	Boston Curb	*35	*33	*34	
East Butte	Boston	3⅛	3	3⅛	Dec., 1919 0.50
First National	Boston Curb	*16	*16	*16	Feb., 1919 0.15
Franklin	Boston	....	....	*40	
Granby Consol.	New York	21	20	20⅜	May, 1919 1.25
Greene-Cananea	New York	16⅛	12⅛	15⅛	Nov., 1920 0.50
Hancock	Boston	....	....	*50	
Howe Sound	New York	34⅛	34⅛	34⅛	Ap.1, Ap.15 0.75
Inspiration Consl.	New York	24⅛	23⅛	23⅞	Jn.7, Jy.6, Q 0.50
Iron Cap	Boston Curb	4	3⅞	3⅞	Jn. 1, Jn. 15 0.50
Isle Royale	Boston	11	10⅛	10⅜	Jn. 1, Jn. 15 0.50
Jerome Verde Dev.	N. Y. Curb	....	....	*67	
Kennecott	New York	55⅛	53⅛	54⅛	Jn. 4, July 1 Q 1.00
Lake Copper	Boston	*80	*80	*80	June, 1925 0.50
Magma Copper	New York	39⅜	37⅛	38⅛	Jn.30, July.15, Q 0.75
Mason Valley	N. Y. Curb	....	....	1⅜	
Mass Consolidated	Boston	*25	*25	*25	Nov., 1917 1.00
Miami Copper	New York	13⅛	12⅛	13⅛	My.1, My.15 Q 0.25
Mohawk	Boston	33⅛	32⅛	33⅛	My.1, Je.1 Q 1.00
Mother Lode Coa.	New York	6	5⅛	5⅛	Jn. 15, Jn. 30 0.37½
Nevada Consol.	New York	14	13⅛	13⅛	Jn. 15, Jn. 30 Q 0.25
New Cornelia	Boston	20⅛	20⅛	20⅛	My.7, M.24 Q 0.40
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*62	*60	*60	No. 14, De. 2 0.05
Old Dominion	Boston	16⅛	15⅛	16⅛	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†130	†120	....	Jun.22, July 2 Q 1.50
Quincy	Boston	19	17⅛	18⅛	Mar., 1920 1.00
Ray Consolidated	New York	14⅛	13⅛	14	Ap.20, Ap.30 0.25
Ray Hercules	N. Y. Curb	....	....	11⅛	
St. Mary's Min. Ld.	Boston	28⅛	27	28	Ap.17, My.18 2.00
Seneca Copper	New York	5⅛	5⅛	5⅛	
Shannon	Boston	*57	*50	*50	Nov., 1917 0.25
Superior & Boston	Boston	*65	*65	*65	
Tenn. C. & C.	New York	12⅛	11⅛	12	My. 29 Ju.15, Q 0.25
United Verde Ex.	N. Y. Curb	27⅛	27⅛	27⅛	Jy.17, Aug. 2, 0.75
Utah Copper	New York	....	....	100	Jn.15, Jn.31, Q 1.25
Utah Metal & T.	Boston	1⅜	1⅛	1 1/16	Dec., 1917 0.30
Victoria	Boston	....	....	*41	
Walker Mining	Salt Lake	....	....	*46	
NICKEL-COPPER					
Internat. Nickel	New York	38⅛	36⅛	37	Jn.17, Jn.30, Q 0.50
Internat. Nickel, pfd.	New York	104	104	104	Ap.15, My.1, Q 1.50
LEAD					
Gladstone M. M. Co.	Spokane	*35½	*34½	*34½	Jn. 10, July 10 0.1½
National Lead	New York	161	157	160	Jn. 11, Jn. 30 Q 2.00
National Lead pfd.	New York	118½	118	118⅜	My.21, Je.15 Q 1.75
St. Joseph Lead	New York	42⅛	40⅛	41⅛	Jn.10, Jn.21 QX 0.75
ZINC					
Am. Z. L. & S.	New York	8¼	8⅛	8⅛	May., 1920 1.00
Am. Z. L. & S, pfd.	New York	36	34	35	Nov., 1920 1.50
Butte C. & Z.	New York	5	4⅞	5	De.10, De.24 0.50
Butte & Superior	New York	11	9⅞	10⅛	Jn.15, Jn.30 Q 0.50
Callahan Zn-Ld	New York	1⅞	1⅞	1⅞	Dec., 1920 0.50
Eagle Picher	Cincinnati	28⅛	27⅞	28⅛	My. 15, Jn.1 0.40
Eagle Picher, pfd.	Cincinnati	....	....	110	Mh.31, Ap.15 Q 1.50
New Jersey Zn.	N. Y. Curb	....	....	208	Jn.9, Jy.10 Q 2.00
United Zinc	N. Y. Curb	....	....	*70	
Yellow Pine	Los Angeles	....	....	*25	De.8, De.18 Q 0.04
GOLD					
Alaska Juneau	New York	....	....	1⅛	
Argonaut	Toronto	*22½	*19	*21	
Barry-Hollinger	Toronto	*44½	*42½	*44½	
Carson Hill	Boston	....	....	*20	
Consol. W. Dome L.	Toronto	*14¼	*14	*14	
Cresson Consol. G.	N. Y. Curb	2⅛	2 1/16	2 1/16	Mh.31, Ap.10 0.10
Crown Reserve	Toronto	*10¼	*10	*10	Jan., 1917 0.05
Dome Mines	New York	14	13⅛	13⅞	Jn.30, July 20, Q 0.50
Golden Center	N. Y. Curb	1⅛	1⅛	1⅛	
Golden Cycle	Colo. Springs	†1.48	†1.47	....	No.30, Dec.10 Q 0.03
Hollinger Consol.	Toronto	20.00	19.85	19.95	Jn. 1, Jn. 17 0.08
Homestake Mining	New York	54	53¼	54	Jn.19, Jn.25 M 0.50
Kirkland Lake	Toronto	1.15	1.04	1.04	
Lake Shore	Toronto	11.45	11.25	11.25	Jn.1, Jn. 15 Q 0.10
McIntyre-Porcupine	New York	25⅛	25⅛	25⅛	My.1, Jn.1 0.25
Newray	Toronto	*33	*33	*33	
Night Hawk Pen.	Toronto	*6	*6	*6	
Noranda	N. Y. Curb	15¼	14⅜	14⅞	
Portland	Colo. Springs	*48	*48	*48	July 6, July 15 0.02
Rand Mines	New York	33⅛	33⅛	33⅛	Fe.16, Fe.26 1.52
Teck-Hughes	Toronto	3.65	3.58	3.61	Ja. 15, Fe. 1 0.05
Tom Reed	Los Angeles	*67	*62½	*62½	Ma.10 Ma.20 0.02
Tough-Oakes	Toronto	*42	*38	*41	
United Eastern	N. Y. Curb	*33	*33	*33	July, 1924 0.05
Vipond Cons.	Toronto	1.81	1.65	1.74	
Wright-Hargreaves	Toronto	8.40	8.25	8.25	Jn.15, Jy.1 Q X 0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	21⅛	
GOLD AND SILVER					
Carnegie Metals	Boston	....	....	16⅛	
Con. Cortez	N. Y. Curb	*6	*6	*6	
Con. Virginia	San Francisco	*6⅛	*5⅛	*5⅛	
Continental Mines	N. Y. Curb	....	....	*45	
Dolores Esperanza	N. Y. Curb	*39	*39	*39	July, 1923 0.05
Tremier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Jn.18, Jy.3 Q 0.08
Tonopah Belmont	N. Y. Curb	3⅛	3	3 1/16	Se.15, Oc.1 0.05
Ponopah Extension	N. Y. Curb	*45	*45	*45	Apr. 1925 0.05
Tonopah Mining	N. Y. Curb	6⅛	5⅞	6⅛	Ap.7, Ap.21 Q 0.07½
Unity Gold	N. Y. Curb	....	....	*20	
West End Consol.	N. Y. Curb	*20	*16	*16	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	....	....	*30	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	N. Y. Curb	....	....	1	Oct., 1920 0.50
Beaver Consol.	Toronto	*78	*75	*75½	May. 1920 0.03
Castle-Trethewey	Toronto	1.44	1.35	1.43	
Coniagas	Toronto	3.30	3.25	3.30	May, 1924 0.12½
Keeley	Toronto	1.49	1.45	1.48	Ma 1, Ma.15 X 0.12
Kerr Lake	N. Y. Curb	1	1	1	Ap.1, Ap.15 0.12½
La Rose	Toronto	*11	*10½	*11	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	....	....	*85	Jy. 2, Jy. 15 0.05
McKinley-Dar.-Sav.	Toronto	*17	*14	*14	Oct., 1920 0.03
Mining Corp. Can.	Toronto	3.52	3.45	3.53	Jy.1, Jy.15 0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Mh.31, Ap.20, Q 0.15
Temiskaming	Toronto	*14	*11	*11	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	8⅛	8	8⅛	Jn.18, Jy.5, Q X 0.25
Alta Merger	Salt Lake	†*5⅛	†*2	....	
Bingham Mines	Boston	36⅛	35	36⅛	Jn.19, Jn.30 Q 1.00
Cardiff M. & M.	Salt Lake	....	....	*51	De.16, No.18 0.10
Chief Consol.	Salt Lake	....	....	2.90	Ap.1, My.1 Q 0.10
Emma Silver	Salt Lake	†*50	†*25	....	
Erupcion	Boston Curb	1⅛	1⅛	1⅛	Jn.18, Jy.5, QX 0.10
Federal M. & S.	New York	72	€8½	70	
Federal M. & S., pfd.	New York	75⅞	72⅞	75⅞	My.25, Ju.15 Q 1.75
Hawthorne Mines	N. Y. Curb	*20	*17	*19	
Hecla Mining	N. Y. Curb	17⅛	17	17⅛	My.15, Je.15 Q 0.50
Iron King Mining	Salt Lake	*28	*28	*28	
Keystone Mining	Salt Lake	*25	*24	*25	Au.12, Au.26 0.07½
Lucky Jim	Spokane	*19½	*17½	*17½	
Mammoth Mining	Salt Lake	2.75	2.75	2.75	Mar.24, Apr. 1 0.10
Marsh Mines	Spokane	*3⅛	*2⅛	*2⅛	Se.15, Oc.1 0.1⅁
Park Utah	New York	6.75	6.70	6.70	Jn.15, Jy.1 Q 0.15
Prince Cons.	Salt Lake	1.75	1.75	1.75	
Silver King Coal	Salt Lake	9.25	9.00	9.25	Jn.21, July 1, Q 0.25
Silversmith	Spokane	*50	*48	*48	Apr. 1, Apr. 10 0.02
Tamarack-Custer	Spokane	*33⅓	*30	*31	Sept., 1924 0.25
Tintic Standard	Salt Lake	13.25	12.87½	13.00	Jn.16, Jn.26, 0.40
Utah-Apex	Boston	9⅛	8⅛	8⅞	Apr. 9, Apr. 15 0.25
Western Utah Copper	N. Y. Curb	....	....	*8	
IRON					
Bethlehem Steel	New York	42⅜	40⅞	41½	July, 1924 1.25
Colorado Fuel & Iron	New York	44⅛	39½	43	May, 1921 0.75
Gt. North'n Iron Ore	New York	22½	20⅛	22½	De. 4, De. 28, 0.75
Inland Steel	New York	....	....	39⅜	My.10, Je.1 Q 0.75
Mesabi Iron	N. Y. Curb	1⅜	1⅜	1⅜	
Replogle Steel	New York	10⅛	9½	10	
Republic I. & S.	New York	52⅞	50⅛	51⅛	May. 1921 1.50
Republic I. & S. pfd.	New York	95	94¼	94¼	Jn.15, July 1, Q 1.75
Sloss-Sheffield S. & I.	New York	131½	127	130	Jn.10, Jn.21 Q 1.50
Sloss-Shef. S.&I. pfd.	New York	104	104	104	Jn 21, July.1, Q 1.75
U. S. Steel	New York	139⅜	134⅛	136⅞	Jn.2, Jn.29 Q 1.75
U. S. Steel pfd	New York	129⅛	128⅛	128⅜	My.4, My.29, Q 1.75
Virginia I. C. & C.	New York	....	....	50	Jan., 1924 1.50
Virginia I.C.&C.pfd	New York	....	....	73	Jn.1, July 2, 2.50
ALUMINUM					
Alum. Co. of Amer.	N.Y. Curb	Ind. 75	73½	73½	
Alum. Co. of Amer pf.	N.Y. Curb	Ind. 99½	99⅛	99⅛	June 15, July 1, Q 0.01½
VANADIUM					
Vanadium Corp.	New York	37⅛	35	36	My.1, My.15, Q 0.75
ASBESTOS					
Asbestos Corp., New	Montreal	24	21	21	De.31, Ja.15 Q 1.50
Asbestos Corp., pfd.	Montreal	79½	74½	75	Jy.1, Jy.15, Q 1.75
SULPHUR					
Freeport Texas	New York	33½	31½	32½	Nov., 1919 1.00
Texas Gulf	New York	145½	139½	143⅜	Jn.1, Jn. 15, Q 2.50
DIAMONDS					
De Beers Consol.	New York	....	....	31½	Ja.26, Fe.2 0.23
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	5⅛	4⅛	5⅛	
MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal	New York	53⅜	51½	53	My.20, Je. 1, Q 1.00
Amer. Metal pfd.	New York	114	114	114	My.20, Je. 1 Q 1.75
Amer. Sm. & Ref.	New York	131	125	128⅞	Jy.10, Au.2, Q 1.75
Amer. Sm.&Ref.pfd.	New York	119	118	118⅛	Au.7, Se.1, Q 1.75
Consol. M. & S.	N. Y. Curb	....	....	208	Jn.30, Jy.5 QX 3.75
Federated Metals	N. Y. Curb	12⅛	12	12⅛	
Newmont Mining	N. Y. Curb	56⅛	55⅛	56	Mar.31, Apr.15, Q 0.60
Southwest Metals	N. Y. Curb	1	1	1	Jn.30, Jy.15 0.60
U. S. Sm. R. & M.	New York	42⅞	40⅛	42	Ap.8, Ap 15, Q 0.87½
U. S. Sm. R.&M.pfd.	New York	49⅞	49⅛	49⅛	Ap.8, Ap.15, Q 0.87½

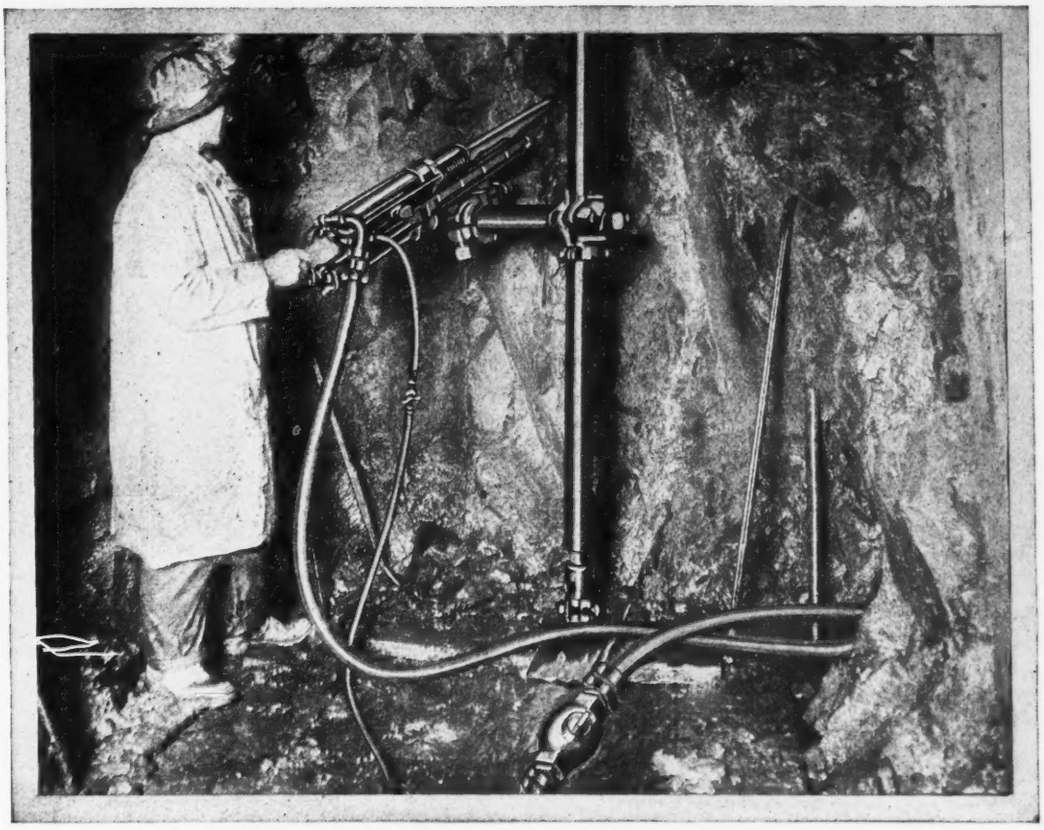
* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED JUNE 8, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	81/10½	80/7½	81/3	May. 1926	5 p.c.†
British Platinum (£1)	6/—	5/6	6/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	15/4½	14/9	14/10½	Feb. 1926	6 annas*
Bwana M'Kubwa (5s)	8/6	7/10½	8/1½		
Camp Bird (£1)	5/—	4/10½	5/—		
El Oro (£1)	6/4½	5/9	6/1½	Nov. 1924	2½ p.c.*
Esperanza (10s)	1 4½	1/—	1/3		
Frontino & Bolivia (£1)	7/6	7/3	7/6	Jan. 1926	1½ p.c.
Mexican Corpn. (£1)	17/1½	16/6	16/9		
Mexico Mines of El Oro (£1)	30/—	28/9	30/—	Dec. 1925	12½ p.c.*
Oroville Dredging (£1)	4/—	3/3	4/—	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/6	2/—	2/1½	May 1925	2½ p.c.
Rhodesian Congo Border	132/6	106/3	127/6		
St. John del Rey (£1)	10/—	9/—	9/9	June 1925	6½ p.c.
San Francisco Mines (10s)	29/7½	28/—	29/3	June 1926	22½ p.c.
Santa Gertrudis (£1)	22/3	21/—	21/9	July 1920	5 p.c.
Selukwe (2s. 6d.)	11/10½	11/—	11/6	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4/6	4/1½	4/6	Nov. 1917	75 p.c.
Tanganyika (£1)	40/4½	37/3	38/9	Sept. 1925	5 p.c.
Tomboy (£1)	3/9	3/6	3/9	Jan. 1926	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	6.600	6.575	6.575	July 1925	150 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.



Model 7 in a Utah Silver Mine Showing Line Oiler Attached

Waugh "Seven" Drifter

There are several reasons for the rapid and widespread popularity of this machine.

Most of the installations to date were made only after a "brass tacks" demonstration of its speed, power and reliability.

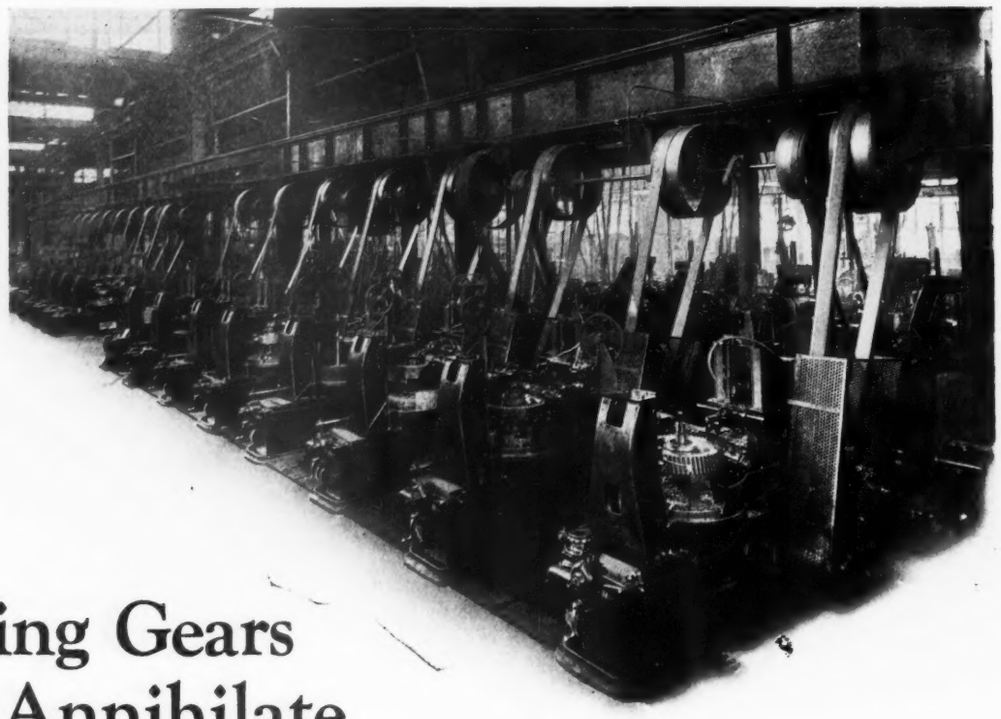
On these three points, plus ease of handling and perfect Line Oiler lubrication, it is winning recognition for unquestioned superiority.

For excessively hard formations, or for high speed tunnel driving, the Model 17 (which is a larger Model 7) is recommended.

THE DENVER ROCK DRILL MANUFACTURING COMPANY

DENVER COLORADO

Branch Offices and Stocks in All Important Centers



Making Gears that Annihilate Vibration

Nuttall Helical Gear

Vibration takes terrific toll of any machinery—possibly greater toll from mining machinery on account of heavy service. Vibration means power losses with excessive costs. Vibration means wear and breakage due to uneven strains, shafts out of line because of worn bearings and general deterioration.

But there is a remedy. Install Nuttall Helical Gears and correct all this trouble and expense. Nuttall Helical Gears are made according to finest manufacturing methods; their correct design insures highest efficiency; and the heat treatment results in a product of extraordinary wear and long life.

The mining industry uses Nuttall Helical Gears extensively. They have the tooth-strength for abnormal loads and practically eliminate vibration.

R.D. NUTTALL COMPANY
PITTSBURGH PENNSYLVANIA

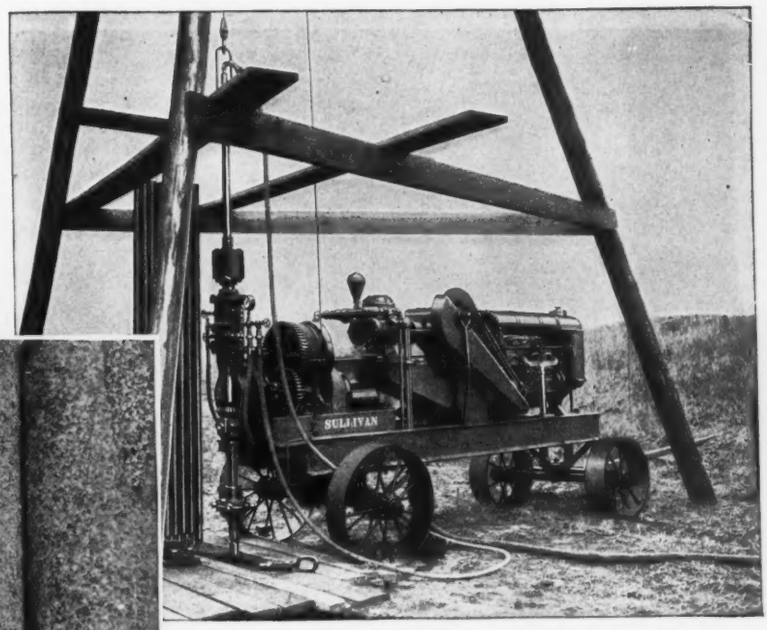
Philadelphia Office—Westinghouse Bldg., 30th and Walnut Sts.
Chicago Office—2133 Conway Bldg.
Wilkes-Barre Office—Miners Bank Bldg.
Salt Lake City Office—Interurban Terminal Bldg.

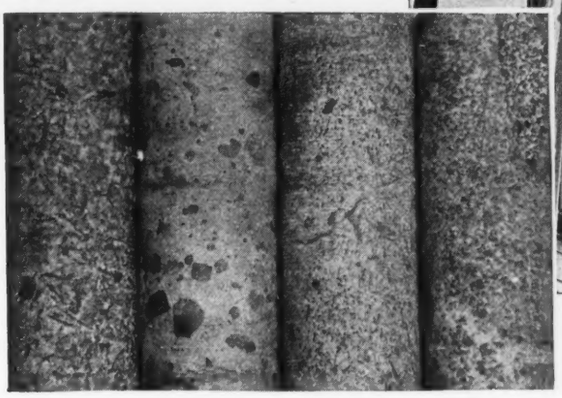
All Westinghouse Electric & Mfg. Co. District Offices are Sales Representatives in the United States for the Nuttall Electric Railway and Mine Haulage Products. In Canada: Lyman Tube & Supply Co., Ltd., Montreal and Toronto.

Nuttall

At Right:
Prospecting with
a Sullivan Portable
Diamond Drill

Below:
A close-up of Diamond
Drill Cores





Is it Worth Developing ?

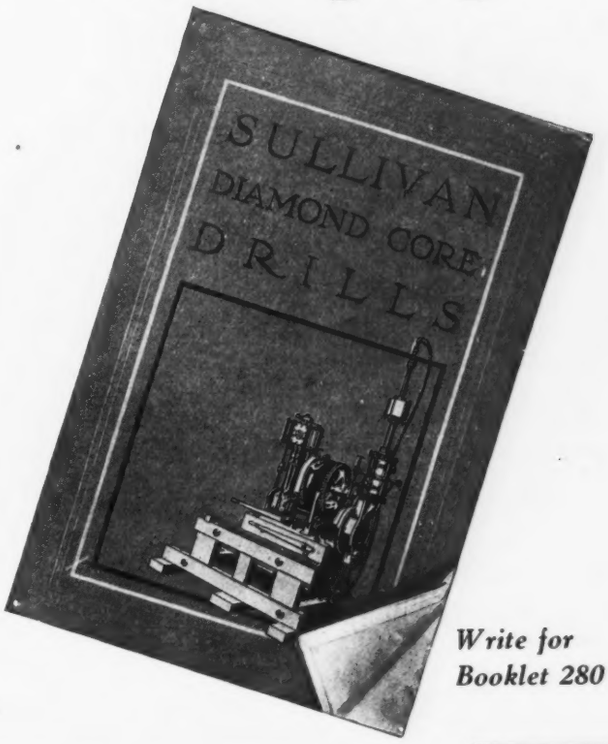
YOUR mineral property may be worth millions, or nothing. How can you find out—if the ore is really there—what it is worth a ton—how far below the surface it lies—the nature of the overlying strata—the most economical way to mine the ore?

This knowledge will determine whether you will develop or abandon your holdings—and this information can be secured accurately, quickly and at low cost with a

Sullivan Diamond Core Drill

If you have undeveloped mineral property or want to block out an ore body from levels in a mine already opened, get our booklet on diamond drilling No. 280. You will find it interesting.

If you have only a small amount of diamond drilling to do, you may find our contract drilling proposition valuable. Expert drill men will block out your deposit with Sullivan Diamond Drills at an agreed rate.



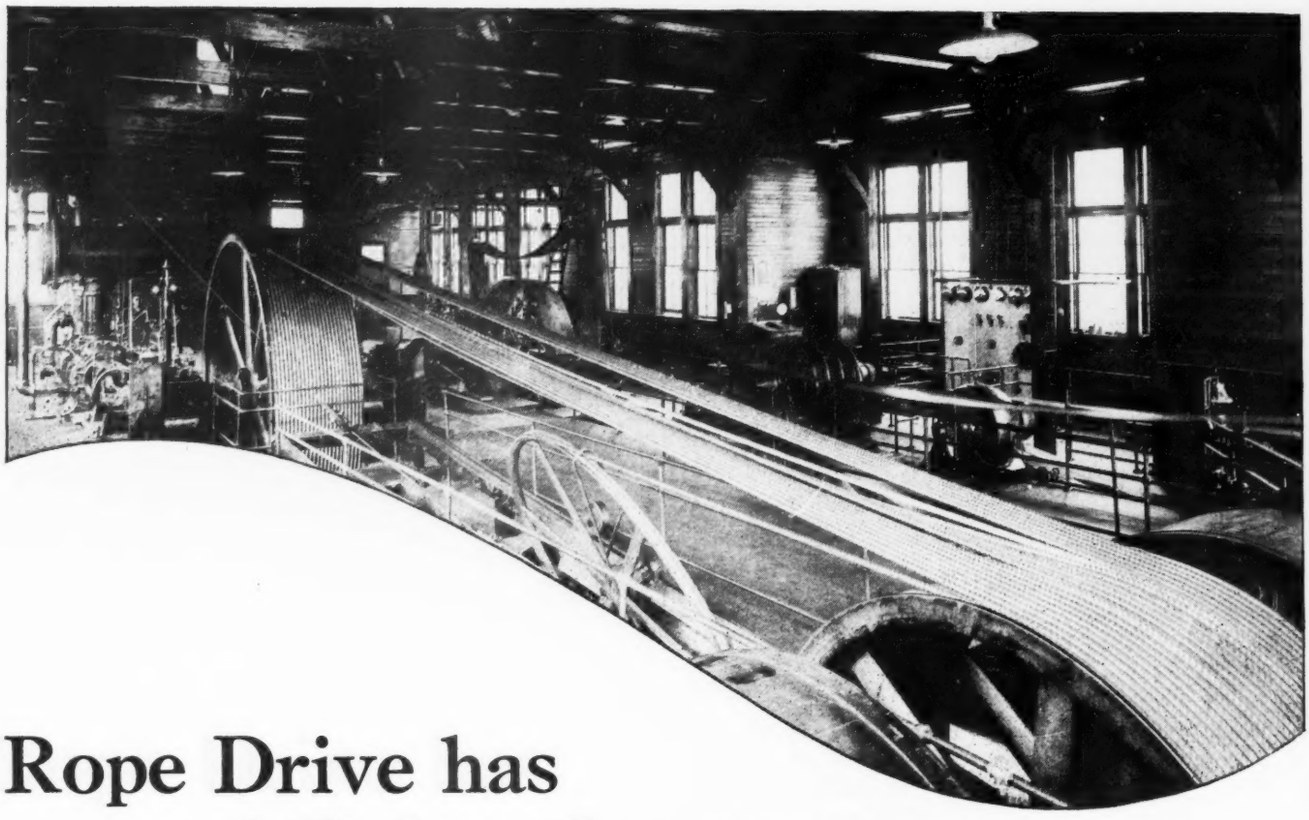
Write for Booklet 280

DOMESTIC SALES OFFICES
Birmingham, Boston, Butte, Claremont, N. H., Cleveland, Dallas, Denver, Duluth, El Paso, Huntington, W. Va., Joplin, Juneau, Knoxville, New York, Pittsburgh, St. Louis, Salt Lake, San Francisco Spokane.

COMPRESSORS AIR LIFT DIAMOND DRILLS SHARPENERS FORGES
FORGE HAMMERS STOPERS ROCK DRILLS DRILLING CONTRACTORS

SULLIVAN TRADE MARK
MACHINERY COMPANY
126 So. Michigan Ave., Chicago

FOREIGN SALES OFFICES
Algiers, Brussels, Calcutta, Christiania, Durban, Natal, Havana, Lima, London, Madrid, Mexico City, Paris, San Juan, Santiago, Shanghai, Sydney, N. S. W., Tokyo, Toronto, Tunis, Turin, Vancouver



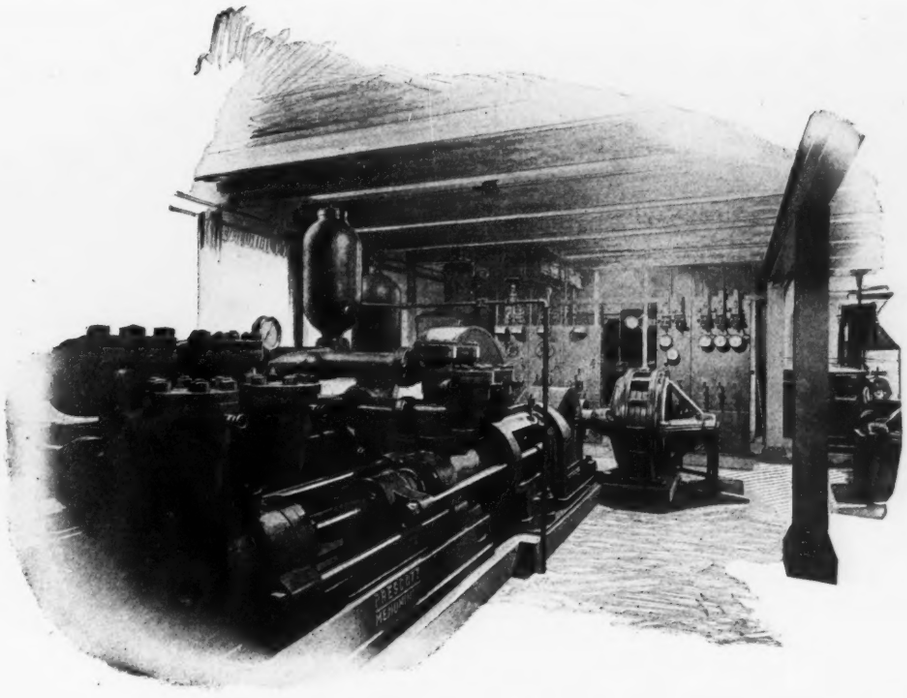
Rope Drive has many definite advantages

It is the ideal drive for maximum center distances. Rope drive is quiet; it produces no electricity; it can be run at any angle; it does not require accurate shaft alignment.

Rope drive takes less space than belting, and it is less expensive for heavy service and long center distances. Select a rope you can trust for dependable service—**Plymouth Manila Transmission Rope**—run it at low tension, and your rope drive should last you from 8 to 10 years—perhaps longer. But be certain you get trustworthy Rope—**Plymouth Rope**—to begin with.

PLYMOUTH CORDAGE COMPANY
North Plymouth, Mass.
Welland, Canada

PLYMOUTH *The Rope You Can Trust*



"If the pumps stop, the mine stops"

Your pump is literally the heart of the mine. It is as important and essential to your mine as the heart is to the human body. "If your pumps stop, the mine stops."

Mine pumps must be able to operate 24 hours a day, week in and week out, without a stop. Big, rugged, powerful pumps, built to withstand all ordinary and shock pressures, are thus the only type of pump suitable for the service.

The records of service established by Prescott-Menominee Pumps cover years of satisfactory dependable operation, and with the lowest of upkeep costs.

The dependability of Prescott-Menominee Pumps demonstrates the efficiency in building such equipment exclusively for its one purpose—mine pumping.

THE PRESCOTT COMPANY
Fred M. Prescott, President
Menominee, Michigan

PRESCOTT
MENOMINEE

Distinguishing Features

These distinctive features assure long life, safety, power and easy operation to the Vulcan Storage Battery Locomotive.

Equalizing Levers

By means of equalizing levers, links and bell cranks the inner ends of the springs are connected. Thus the same equalization of pressure on the journals, as secured for the Vulcan Trolley and Steam, Locomotives, has been made possible for the Vulcan Storage Battery Locomotive.

Worm-Gear Drive

By means of a segmented shaft, flexible couplings and worm gearing, motion is transmitted from the single motor to the driving axles. Thus is utilized a type of drive the utility of which has been proven in motor trucks, tractors, etc.

Self-Locking Brake

A quick-acting, self-locking brake, similar to that of the Ford automobile, makes sudden stops a simple operation for the driver. Throwing a lever, which actuates a cam, through a half circle, applies or releases the brake.

Cast-Steel Bar Frame

Maximum strength, minimum weight and ample ventilation are secured by the cast-steel bar frames on each side of the body.

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Roasters
Fairchild Double-Discharge Ball Mill
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Corliss Engines
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery

You can stop it in a jiffy!

The brake on the Vulcan Storage Battery Locomotive is not unlike that on a Ford automobile. And you know how quickly and easily you can stop a "flivver."

Mighty useful, a quick-acting brake, underground when there are men, mules or a wreck just around the turn. The headlight spots the danger only thirty feet ahead; but the driver of the Vulcan throws the lever, and all's safe!

It will pay you to learn all the features of the Vulcan Electric Locomotives. They're listed in the panel on this page and described fully in the latest Vulcan Bulletins. Send for your copy.

VULCAN IRON WORKS

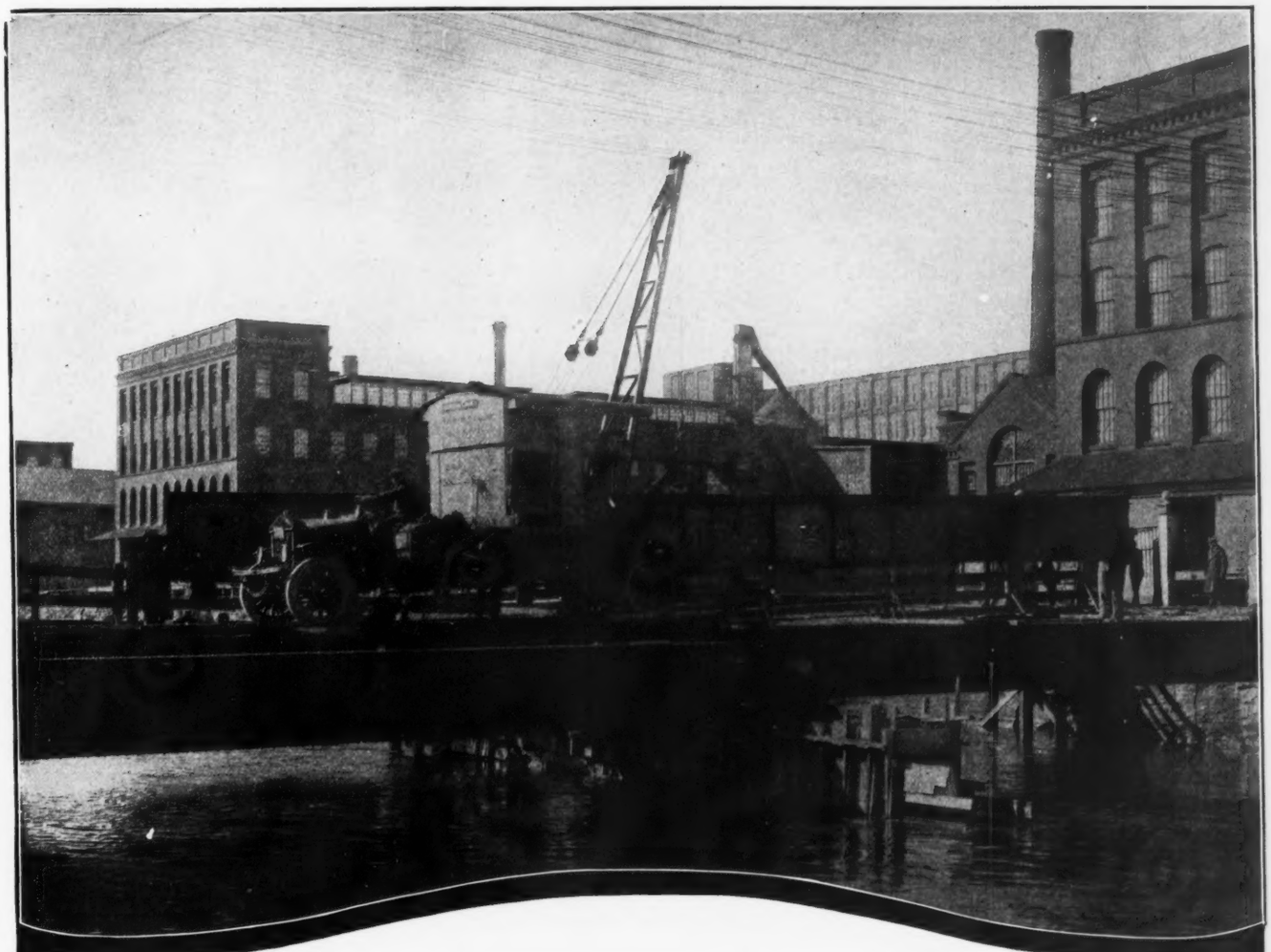
Established 1849

WILKES-BARRE, PA.

New York Office:
50 Church St.

Chicago Office:
McCormick Bldg.

VULCAN *of* WILKES-BARRE
LOCOMOTIVES



Here's a 5-Ton

Universal Crane

Equipped with

WILLIAMSPORT *Telfax Tape marked—Factory certified* WIRE ROPE

handling a 7-ton girder 52 ft. long 48 in. deep as easy as a man picking up a piece of firewood.

The significant thing about this is the power of the crane and ease in handling—but if the manufacturer used cheap rope of uncertain tensile strength on the job, the whole apparatus might as well be cheap.

Manufacturers of good, reliable machinery are fast getting away from considering ropes of uncertain tensile strength. They are turning to "Williamsport" the only wire rope made that proves its grade by plain English evidence woven into every inch of their wire rope.

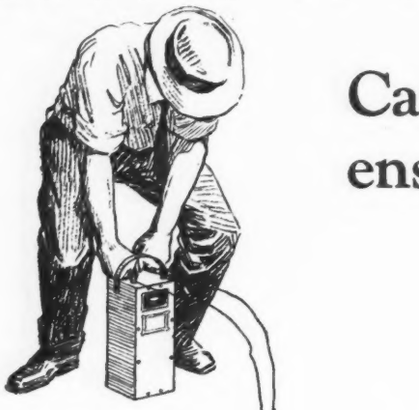
They prefer to pay a little more and be *sure;* than to use unmarked ropes and *guess* on the grade.
The good name of any manufacturer is not a guarantee against mistakes.

WILLIAMSPORT WIRE ROPE COMPANY

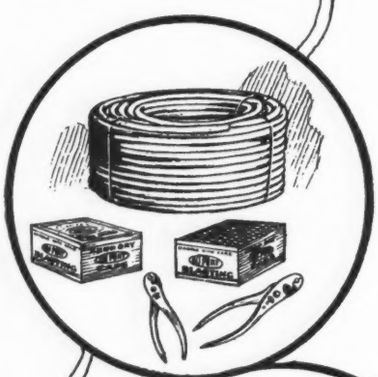
Main Office and Works:
Williamsport, Pa.

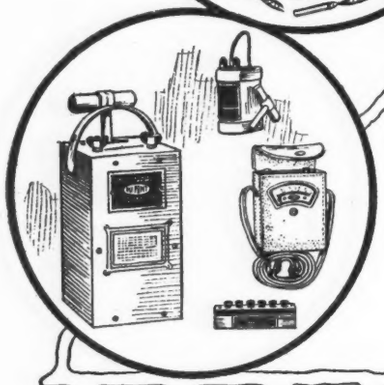
General Sales Offices:
Peoples Gas Bldg., Chicago

MAKERS OF POWDERS SINCE 1802



Careful preparation ensures complete detonation





"FOR want of a nail the shoe was lost; for want of a shoe the horse was lost; and for want of a horse the rider was lost."

Everyone who has anything to do with blasting work thoroughly appreciates this way of Benjamin Franklin's saying, "Perfection is the sum of many details." Production of materials, efficient work, progress and prevention of accidents are dependent upon the reliability of such an agent as a blasting cap.

Yet the actual cost of reliable blasting accessories is relatively so trifling that it is obviously wasteful to compromise with anything less than the accessories made by du Pont, thoroughly dependable for three very logical reasons:

FIRST: **Du Pont Blasting Accessories are the products of the oldest explosives manufacturer in the country —125 years of explosives experience.**

SECOND: **Right because made in the most complete explosives plants in the world; rigidly inspected at every step of manufacture, and their performance practically observed in the field.**

THIRD: **That no other accessories perform more efficiently is demonstrated by the increasing demand for du Pont Blasting Accessories.**

Don't temporize! The most economical way is the sure way — insist on the use of du Pont Blasting Accessories.

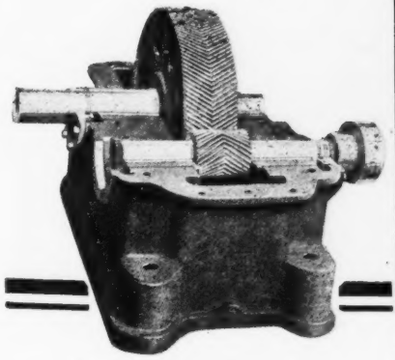
Send for catalog giving practical data relating to selection and use of du Pont Blasting Accessories.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
WILMINGTON, DELAWARE

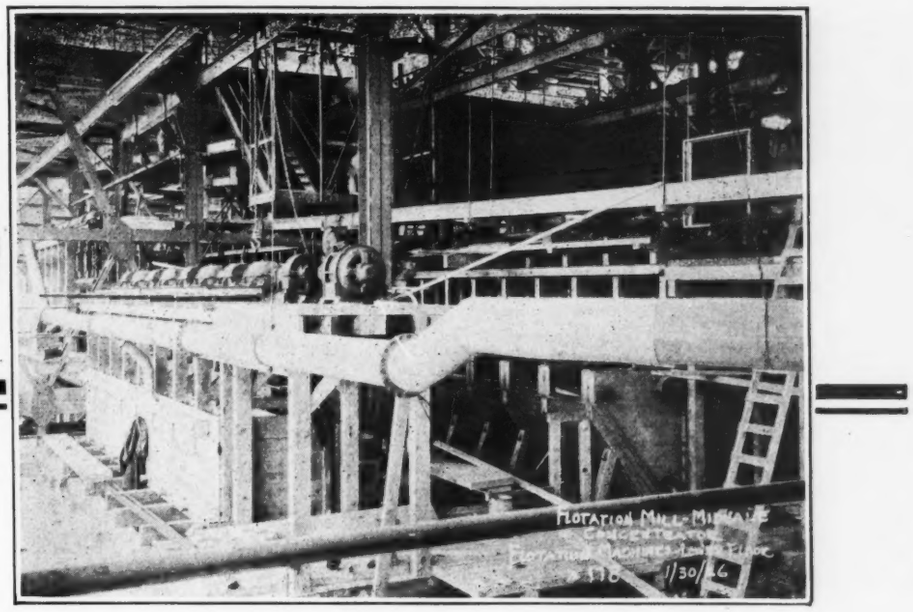
DU PONT

Blasting Accessories

125 YEARS OF LEADERSHIP IN THE SERVICE OF INDUSTRY



View with cover removed showing gears. Sykes Standard Single Reduction totally enclosed gear-drive unit.



Driving the Flotation Machines with Sykes Gear Reduction Units

Sykes generated double gears with continuous teeth and sharp apices.

At the new selective flotation mill of the U. S. Smelting, Refining & Mining Company at Midvale, Utah, twelve Minerals Separation flotation machines are driven through reduction units as follows:

Three 60 h.p. Sykes Gear Reduction Units with ratio of 865 to 280 R.P.M.; three 50 h.p. Sykes Gear Reduction Units with ratio 865 to 266 R.P.M.; and six 40 h.p. Sykes Gear Reduction Units with ratio of 855 to 280 R.P.M. Five rod mills and the classifier line shaft are also driven by the same. The units are all driven by G-E reduction motors.

The Sykes method of cutting continuous herringbone teeth produces gears of enormous load-carrying capacity, which operate silently, without a trace of vibration, and with a mechanical efficiency of 98½% to 99.44%.

Their use in reduction units insures absolute reliability under all conditions of service. These gear units withstand 100% overloads, need no attention and cost nothing for maintenance.

All sizes from ¼ H.P. up to 3000 H.P. and all ratios up to 200 to 1. Six distinct designs and twenty sizes of each design, available for immediate application.

Write for Bulletins.

FARREL FOUNDRY & MACHINE CO.

BUFFALO, N. Y., U. S. A.

New York, N. Y., 79 Wall St.
Boston, Mass., 914 Little Bldg.
Cleveland, Ohio, 802 Swetland Bldg.
Pittsburgh, Pa., 649 Union Trust Bldg.
Mexico City, Mexico Apartado 2361, 215 Cidosa Bldg.
San Juan, Porto Rico
Havana, Cuba, Edificio, Canada

PLANTS LOCOATED AT BUFFALO, N. Y. AND ANSONIA, CONN.

The Gear with FARREL *a Backbone*

SYKES GEARS

DRACCO?—They once said, "No!"

Now they want additional units

Not only that—but the manager of the Smelter complained because Dracco was too efficient! For at first, on account of certain fuels used, Dracco was taking over some of the carbon smoke which in turn slightly discolored their oxide.—This condition was remedied and—just recently we have augmented the original equipment.

The Dracco System—thoroughly tested and proven in various Smelters—is able to handle your dust recovery problems in a highly profitable manner.

Perfecto Filters, a vital and distinct part of the Dracco System are handling such work as filtering gases from fuming and blast furnaces, filtering air from atomizers, grinding mills, packers and transport equipment.

No doubt you have problems in connection with Dust Collecting or Pneumatic Conveying.—Dracco Engineers have helped others—let them consider your problem. Also send for interesting bulletins that will show you a few pertinent facts.

Some Dracco Installations

United Lead Co.
Maurer, N. J.

Tottenville Copper Co.,
Tottenville, N. Y.

Evans Lead Co.
Charleston, West. Va.

John Lewis Sons & Co.,
Philadelphia, Pa.

Carter White Lead Co.,
Chicago, Ill.

The Dust Recovering & Conveying Co.
ENGINEERS AND MANUFACTURERS
CLEVELAND, OHIO

DRACCO DOES IT

THE high hydraulic efficiency of "American" pumps, their compact design and their sturdy construction all make for years of low cost performance. They are largely preferred by consulting engineers—whose discriminating opinion can be safely accepted as a criterion.

Branch Offices:

Chicago, Ill. ..... First National Bank Bldg.
Milwaukee, Wisc. ..... Wisconsin National Bank Bldg.
New York, N. Y. ..... 165 Broadway
Dallas, Texas ..... Western Indemnity Bldg.
San Francisco, Calif. ..... 635 Mission St.

District Sales Agencies:

Philadelphia, Pa.	Kansas City, Mo.	Denver, Colo.
Pittsburgh, Pa.	Joplin, Mo.	Salt Lake City, Utah
Cleveland, Ohio	Atlanta, Ga.	Phoenix, Ariz.
Detroit, Mich.	Birmingham, Ala.	Los Angeles, Calif.
St. Paul, Minn.	Jacksonville, Fla.	Charlotte, N. C.
Omaha, Neb.	New Orleans, La.	Calgary, Alta., Can.
St. Louis, Mo.	Roswell, N. Mex.	Boston, Mass.

THE AMERICAN WELL WORKS

General Office & Works
AURORA, ILL.

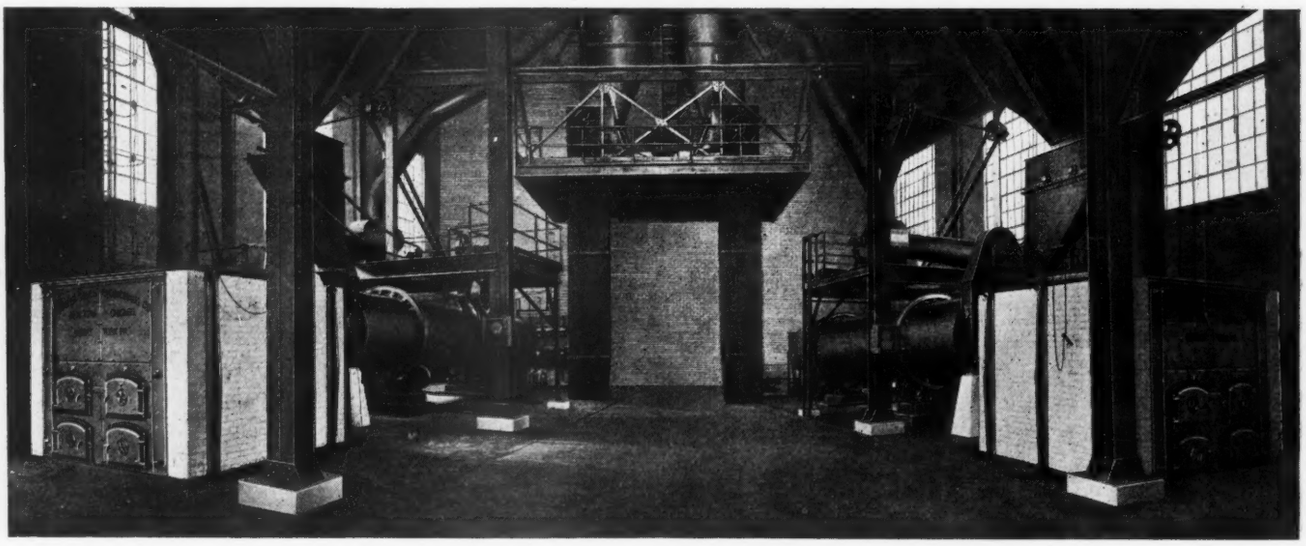
Why I Would Buy A Ruggles-Coles Dryer

I'd be buying from the originator of the Double Shell Type Dryer, and from a Company which has always adapted every improvement developed through use.

I'd be buying from one of the oldest and most reputable manufacturers of drying equipment, whose engineers have demonstrated their understanding of a wide range of drying problems.

I could rely on their recommendations and depend upon the manufacturer giving service if it was needed.

I'd be following the lead of more than 1800 other users of Ruggles-Coles Dryers, including many of the largest mining and industrial plants in the world, who must certainly have made a thorough investigation before buying.



Ruggles-Coles Engineering Division

of the Hardinge Company, Inc.

York, Pa.

120 Broadway, New York

Newhouse Bldg., Salt Lake City

A New Handbook for Metallurgists

Essential non-ferrous metallurgical data
The work of more than thirty specialists

AMERICAN metallurgists have long wanted an engineering handbook such as electrical engineers have in the STANDARD, such as mechanical engineers have in MARKS, such as highway engineers have in HARGER AND BONNEY, such as chemical engineers have in LIDDELL'S HANDBOOK OF CHEMICAL ENGINEERING. Requests and inquiries for such a book came to us regularly. We made a survey of the demand, of the scope such a book should cover, of the men who could best prepare such a book. Out of this survey has grown

Handbook of Non-Ferrous Metallurgy

Editor-in-Chief—DONALD M. LIDDELL—Consulting Engineer

Formerly Editorial Staff of Engineering and Mining Journal-Press; formerly Secretary, Mining and Metallurgical Society of America; President, Crown Cork and Seal Co.

Assisted by 33 Specialists

Two volumes, 6x9, flexible, about 1500 pages. After publication (July 15, 1926)—$12.00 per set. Special pre-publication price—$10.00 per set.

This two-volume handbook is the work of more than 30 specialists. It has been written especially for metallurgists in practice. It reflects throughout its material the practical viewpoint of what information is most needed.

Those processes and materials that are common to all metallurgical operations—such as the use of refractories, of fuels, the general methods of concentration, of filtration, etc.—are treated in separate chapters by men of long experience in these fields. These chapters are followed by descriptions of the metallurgy of each of the non-ferrous metals.

A professional handbook of real utility

Always, throughout the book, the emphasis is placed on the kind of information the metallurgist needs and wants. In the case of copper and lead, for example, the treatment concerns itself with the extraction of the metal from the ore. In the case of aluminum and magnesium, where it is unlikely that the engineer will ever be called upon to design a reduction works, or to work in any plant except one with an established metallurgy, much of the space is given to the useful alloys and how to work with them. These examples are cited to show how carefully the contributors to this handbook have tried to gauge the metallurgist's real needs.

An outline of a typical chapter

Here is an outline of Chapter XX of the book. This chapter is entitled Metallurgy of Magnesium and Magnesium Alloys and is the work of Dr. Robert J. Anderson. It discusses:

—historical survey;
—producers and output;
—markets and prices;
—sources, ores and minerals;
—production;
—magnesium chloride process;
—oxide process;
—commercial forms of magnesium;
—chemical properties;
—corrosion;
—physical and mechanical properties;
—alloys;
—melting and casting;
—mechanical treatment;
—metallography;
—uses and applications of magnesium and magnesium alloys;
—selected bibliography.

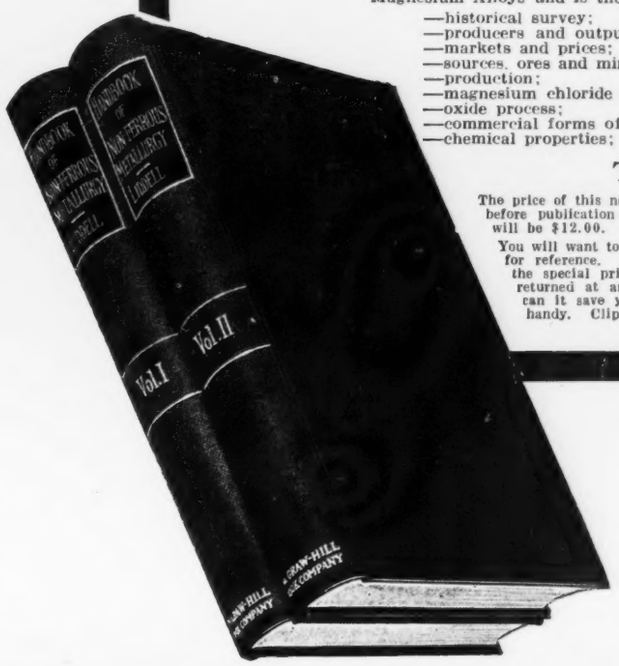
Special Pre-Publication Offer

This new handbook will be published about July 15, 1926. After publication the price of the work will be $12.00 per set.

To those who place their orders now, we will supply the two volumes on the day of publication at **a special pre-publication price of $10.00 per set.**

Orders, of course, are on our usual ten-day free examination basis with full return privilege included.

Register your request now —at special price



This offer saves you $2.00

The price of this new handbook to you if you request a copy for free examination before publication is $10.00. On and after publication (July 15) the price will be $12.00.

You will want to see this work. We believe you will want to have it handy for reference. By arranging to see it NOW you get the advantage of the special price—with full privilege of return. The coupon may be returned at any time for two cents—but only by returning it now can it save you $2.00. The bargain is obvious. The coupon is handy. Clip and mail it today!

Mail just this coupon

Special Pre-Publication Free Examination Coupon

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, N. Y.

Send me Liddell's HANDBOOK OF NON-FERROUS METALLURGY (Two Volumes), when published, for 10 days' free examination.

I agree to return the book, postpaid, in 10 days or to remit the special pre-publication price of $10.00 at that time.

Name .....

Address .....

Position .....

Name of Company .....

(This offer stops the day the book is published. Regular price after publication, $12.00.)

J. 6-26-26

If you must use your blowpipe as a hammer

or leave it in the road to be smashed by the factory truck, pick up the pieces and send them to the nearest Oxweld apparatus repair station.

There are 21 Oxweld repair stations throughout the country. One of them is near you. Mail or express your blowpipe direct to this nearest station and it will be back in service before you know it, for a nominal charge.

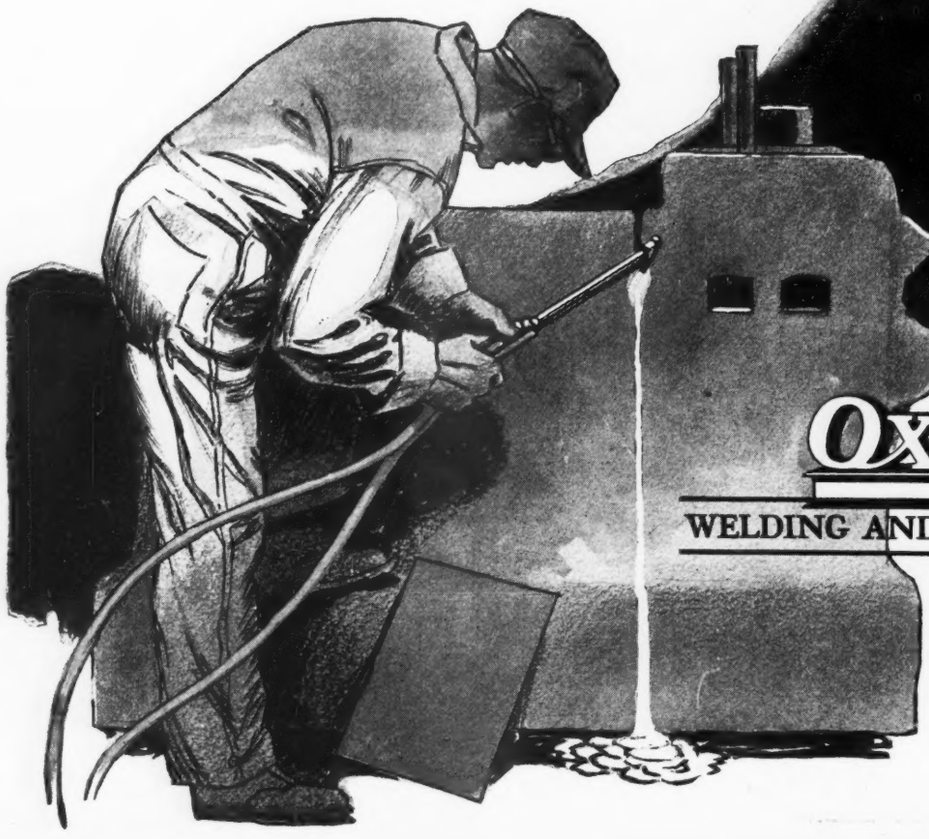
Oxweld repair stations are factory supervised and give the same careful service that you would get from the factory direct. Saving time and money for our customers is our main reason for establishing them.

OXWELD ACETYLENE COMPANY

Chicago	Long Island City, N. Y.	San Francisco
3642 Jasper Place	Thompson Ave. & Orton St.	1050 Mission Street

OXWELD
Apparatus Repair Stations

Baltimore
Birmingham
Boston
Buffalo
Chicago
Cleveland
Denver
Detroit
Houston
Los Angeles
Minneapolis
Newark
Omaha
Philadelphia
Pittsburgh
Portland
St. Louis
Salt Lake City
San Francisco
Seattle
Tulsa



Oxweld
WELDING AND CUTTING APPARATUS

A Message to every mine manager and drill runner in the industry!

The Colonial Rock Drill Steel booklet, sent free, contains information of interest to every mine.

This Is the Test

IT is breakage that runs up your drill steel costs. And breakage is first of all the direct result of dull bits. In fact, the sharp bit seldom breaks.

You can save with Red Star Drill Steel because it holds its edge and its gauge longer. Also Red Star is tough, hard, wonderfully resistant.

That means with Red Star you gain in cutting speed, reduce re-sharpening and bring breakage to the minimum. Your net result is increased production at less cost.

Red Star is furnished in all standard sizes; round, hexagon, octagon or quarter-octagon; hollow or solid. Your jobber or the nearest Colonial warehouse will supply you.

COLONIAL No. 7
A Vanadium Tool Steel

Used in dies, dollies, tappets, pistons and hammers it has doubled the service. Vanadium adds durability. Colonial No. 7 is a Vanadium Steel produced in a mill that makes only fine Tool Steels.

Colonial Steel Company

PITTSBURGH NEW YORK CHICAGO BIRMINGHAM ST. LOUIS
DENVER SALT LAKE CITY PHOENIX EDW. L. SOULE CO., SAN FRANCISCO

An Accurate Operation Record *of Every Machine*

A Bristol Operating Recorder enables the superintendent to have an indisputable 24-hour record of the operation of any machine in the plant—elevators, cars, conveyors, crushers, grinding machinery and various other equipment. This instrument records not only the fact of the operation, but also the time and extent of the movement. It is made in two types—mechanical or electrical. The electrical recorder can be furnished with any number of pen arms up to twenty, and can be installed a long distance from operations to be recorded.

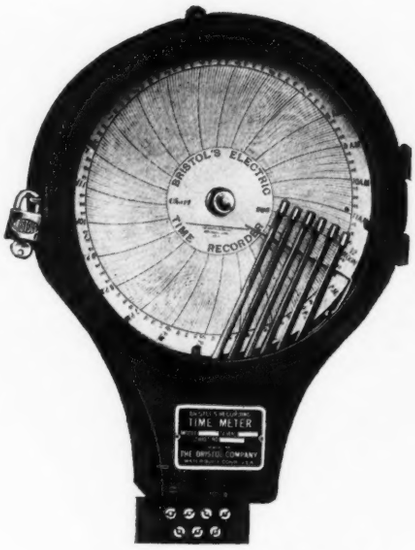
Continuous operating records of your principal equipment should enable you to improve operating efficiency with attendant lower production costs.

Look us up in our booth (make it your headquarters) at the Sesquicentennial Exposition in Philadelphia

The Bristol Company *Waterbury, Connecticut*

FOR 36 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS



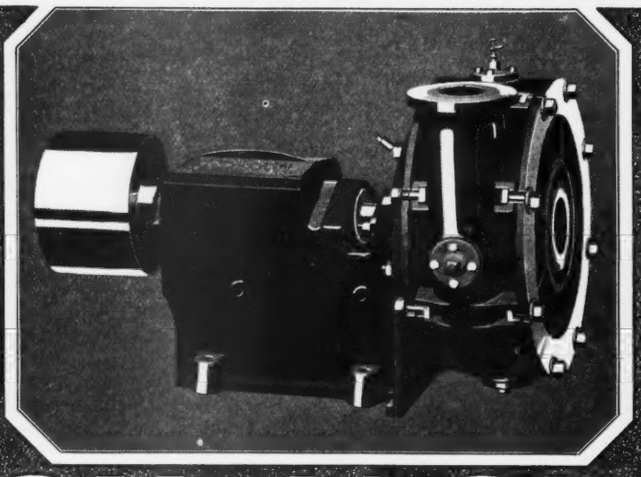
Bristol's Operation Recorder

BRISTOL'S
Recording Instruments

Pyrometers	Liquid Level Gauges	Frequency Meters
Thermometers	Tachometers	Long Distance Transmission Systems
Pressure Gauges	Time Recorders	Et cetera.
Vacuum Gauges	Ammeters	
Temperature Controllers	Voltmeters	
Psychrometers	Watt Meters	

BYRON JACKSON
RUBBER LINED SLIME PUMP

For handling slimes, mill concentrates or other highly abrasive materials, the life of the Rubber Lined Pump is many times longer than pumps lined with the hardest metal.



Impeller and interior of pump case are entirely covered with a layer of tough vulcanized rubber similar to tread of an automobile tire, affording extreme resistance to abrasion.

BYRON JACKSON
PUMP MANUFACTURING CO. INC.
FACTORY AND MAIN OFFICE: BERKELEY, CAL.
BRANCHES: SAN FRANCISCO, LOS ANGELES, VISALIA, PORTLAND, OR. SALT LAKE CITY

Repeat Orders are Best Proof

The first drill used in the California-Rand silver mines at Randsburg, Calif., was a Cochise. This drill is still in operation — many more Cochise Drills have since been installed.

Fast drilling and low air consumption reduces overhead expenses and increases production. That's why Cochise drills are used extensively.

Sold by

Cochise Rock Drill Mfg. Co., Los Angeles, Calif.
The Mine & Smelter Supply Co., Salt Lake City, Utah
The Arizona Mine Supply Co., Prescott, Ariz.
Jules L. Vermeersch, Phoenix, Ariz.
A. H. Cox & Co., Inc., Seattle, Wash.
General Machinery Co., Spokane, Wash.
Robertson & Moss, Johannesburg, South Africa
International Steel Co., Portland, Ore.
Rix Company, Inc., San Francisco and Los Angeles, Calif.

Manufactured by

Cochise
ROCK DRILL MFG. CO., LOS ANGELES, CAL.

Procrustes
Would never have succeeded in the Filter Business

UNITED
AMERICAN SWEETLAND KELLY
FILTERS

You remember Procrustes, the Greek robber, who used to make a captive fit a "one size" bed. If the victim was too long Procrustes cut off his head—if too short, a stretching rack made him fit.

Buyers of filter equipment are sometimes captured by Procrustes. They try to make one type of machine fit the filtering problem by "stretching" the operating costs or "shortening" efficient operation.

Procrustes is no salesman for the United Filters Corporation.

We manufacture four different types of filters. When you come to us you are certain to get *one* best adapted to your problem, best suited to your production and best equipped to give you the most service.

Instead of trying to fit your problem to a filter —let us fit a filter to your problem. Any one of our offices will make the recommendation. Write the nearest.

INCO MONEL METAL

Here Are the Four Filters:

1. Sweetland Pressure Filters
2. Kelly Pressure Filters
3. American Continuous Filters
4. United Filter Presses

We Also Make The Sweetland Thickener

UNITED FILTERS CORPORATION

Main Office: Hazleton, Pennsylvania

New York Chicago Salt Lake City Los Angeles
Export Office: 25 Broadway, New York City
Code Address—Unifilter, New York

Why Soft-Ground Miners Prefer the CP-8A

THE CP-8A Hammer Type Rock Drill cuts through soft ground formations as in coal, iron ore, shale and similar drilling at high speed.

Auger steel bits are used to remove drill cuttings while in operation.

Powerful down-stroke rotation keeps the drill from stalling in heavy or sticky ground.

Expensive breakdowns and costly tie-ups that raise the average operating cost for footage drilled are eliminated by their design and construction.

Detailed description of the CP-8A and other CP hand hammer rock drills is given in Bulletin 850. Write for your copy.

Chicago Pneumatic Tool Co.
Chicago Pneumatic Bldg. 6 East 44th St., N. Y.
Sales and Service Branches all over the World
R-56-S

Builders of

GOOD CARS

Since 1863

— Catalogs —

The Watt Car and Wheel Co.
Barnesville, Ohio

Selling "Watt Quality Products"

Pittsburgh, Pa., W. C. Wilson, 1135 Greenfield Ave.
Huntington, W. Va. J. E. Graham, 341 Sixth Ave.
New York, N. Y. C. R. Gier Co., 66 Beaver St.
Chicago, Ill. W. W. Baker, 140 So. Dearborn St.
San Francisco, Cal. N. D. Phelps, Sheldon Bldg.
Denver, Colo. Lindroth, Shubart Co., Boston, Bldg.
Birmingham, Ala., Industrial Supply Co.

POOR VENTILATION?

You need a Coppus!

With Coppus VANO OR VENTAIR properly installed you will have good air anywhere in your mine

Compressed Air Driven
Electric Motor Driven
Single Unit Design
Portable - Rugged - Reliable

LOW PRICED

BLOWERS **Coppus Engineering Corp.** EXHAUSTERS
356 Park Ave., Worcester, Mass.

PATRICK CARBON

for Diamond Core Drilling

When you buy carbon from Patrick you expect the utmost in economy and satisfaction. Patrick facilities for buying, Patrick fidelity in grading, and Patrick fairness in selling are your absolute guarantee under all drilling conditions.

R. S. PATRICK
Duluth, Minnesota, U.S.A.
Cable Address, "Exploring" Duluth

Automatic Aerial Tramway, designed and installed by the Interstate Equipment Corp. of New York, Lincoln Coal Co., Napfor, Ky. This tramway handles 150 tons per hour, 1800 ft. from mine to tipple. The entire system is under control of one man, who simply presses a button to start or stop operation.

1800 feet on HAZARD Wire Rope

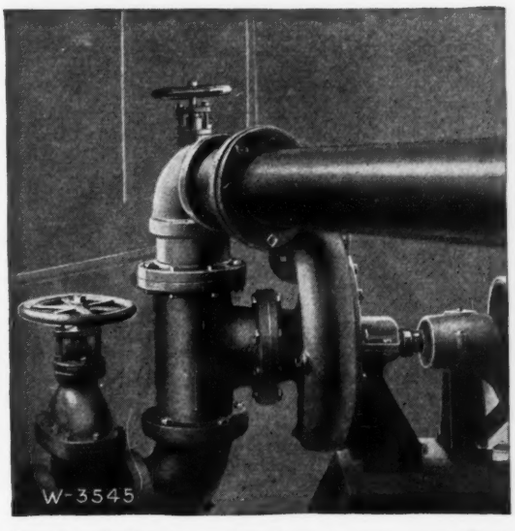
The Lincoln Coal Co.'s Automatic Aerial Tramway typifies the popular modern way of bringing coal from mine to railway over any distance or country. The tracks and cables are made of Hazard Wire Rope, which, with its superior design and construction, assures long, dependable service.

The advice and counsel of our wire rope service engineers are yours for the asking.

Hazard Manufacturing Company
Wilkes-Barre, Pa.

New York Denver Pittsburgh Birmingham Chicago

Handled 40,000 tons of iron ore tailings without replacements



Stocks of these popular pumps are carried at the various Worthington distribution centers throughout the country to insure prompt delivery.

A SIX-INCH Worthington Class C Pump recently handled 40,000 tons of iron ore tailings without replacements. Such service is not unusual from Class C volute pumps. They are true contractors' pumps in every sense of the term—easily moved about, always ready for service and capable of handling almost anything that has to be pumped.

Suited for any type of drive and of reasonable first cost, a Class C pump is a good investment for any one who has rough and ready pumping jobs. Sizes range from one inch to eight inches; capacities 10 to 3,400 gal. per min.; heads up to 80 ft.

WORTHINGTON PUMP AND MACHINERY CORPORATION
115 BROADWAY, NEW YORK BRANCH OFFICES IN 24 CITIES

WORTHINGTON

6631-9

AMERICAN BRIDGE COMPANY

EMPIRE BUILDING—71 BROADWAY NEW YORK, N. Y.

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

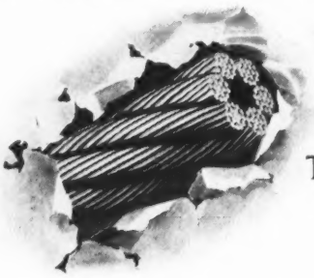
ALSO STEEL BARGES FOR HARBORS AND RIVERS, STEEL TOWERS FOR ELECTRIC TRANSMISSION, HEROULT ELECTRIC FURNACES, ETC.

SALES OFFICES:

NEW YORK, N.Y. Philadelphia, Pa. Boston, Mass. Baltimore, Md.
PITTSBURGH, PA. Cincinnati, Ohio Cleveland, Ohio Detroit, Mich.
CHICAGO, ILL. St. Louis, Mo. Denver, Colo. Salt Lake City, Utah Duluth, Minn. Minneapolis, Minn.
Pacific Coast Representative: U.S. Steel Products Co., Pacific Coast Dept. San Francisco, Cal. Los Angeles, Cal. Portland, Ore. Seattle, Wash.

Export Representative: United States Steel Products Co., 30 Church Street, New York.

Roebling

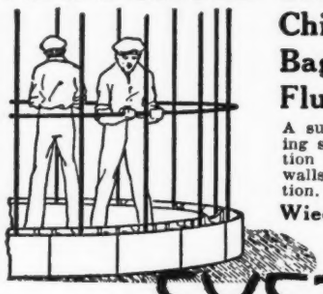


Wire Rope

Triumphs thru the test of time

John A. Roebling's Sons Co., Trenton, N.J.

WIEDERHOLDT REINFORCED TILE CONCRETE SYSTEM



Chimneys
Bag Houses
Flues—Buildings

A successful modern method securing speed and low cost in construction with indestructible air tight walls. Write for complete information.

Wiederholdt Construction Co.
St. Louis, Mo.

MECHANICAL RUBBER GOODS for Every Mining Need

Belting
Transmission
Conveyor
Elevator
Packing
Hose

US Trade Mark

US Trade Mark

United States Rubber Company
1790 Broadway New York City
Sales Branches in Every Industrial Center

ACID PROOF CHIMNEYS

for Industries using Metallurgical Processes; built of

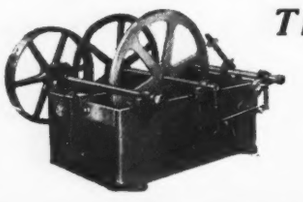
Impervious Radial Brick

For Smelters, Furnaces, Ovens, Boilers, All Sizes. Builders of the Tallest and Largest Chimneys in the World.

Experts in Refractory Brick Work and Boiler Settings

Alphons Custodis Chimney Cons. Co.
95 Nassau St., New York
Marquette Bldg., Chicago

Send for Free Booklet E.M. 10, "Construction and Design of Chimneys Subjected to Acid Gases"



The Southwestern OIL FEEDER

Write for Catalog "E"

SOUTHWESTERN EQUIPMENT

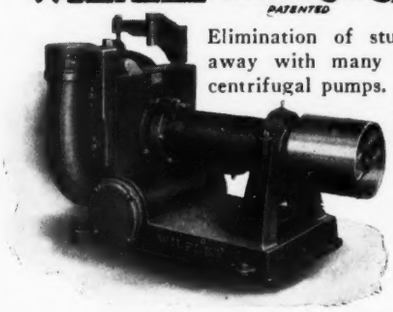
for Ore Treatment
K&K Flotation Machines.
Southwestern Ore and Oil Feeders.
Cottrell Screens, Tables, etc.
Complete Milling Plants.

for Oil Treatment
Condensers.
Heat Exchangers.
Gasoline Absorption Plants.
Complete Refinery Apparatus.

SOUTHWESTERN ENGINEERING CORP.
1221 Hollingsworth Bldg. Los Angeles, Calif.

WILFLEY Centrifugal SAND PUMP

PATENTED



Elimination of stuffing box has done away with many troubles common to centrifugal pumps.

Pump maintains extraordinary efficiency.

Wearing parts unusually heavy, insuring long life.

Cleaning out pump or changing wearing parts requires only a few minutes.

Described and illustrated in our new Catalog

A. R. Wilfley & Sons, Denver, Colorado, U.S.A.

A Complete line of Compressed Air Machinery for the Mine

Products

AIR COMPRESSORS
Any Capacity
Any Pressure
Any Drive
Stationary
Portable
ROCK DRILLS
DRILL STEEL SHARPENERS
"LITTLE TUGGER" HOISTS
TURBO BLOWERS
OIL ENGINES
Stationary
Marine
OIL ENGINE-ELECTRIC LOCOMOTIVES
AMMONIA COMPRESSORS
GAS COMPRESSORS
GASOLINE EXTRACTION COMPRESSORS
VACUUM PUMPS
AIR LIFT PUMPS
CONDENSERS
Surface
Barometric
Multi-Jet
PNEUMATIC TOOLS
CAMERON PUMPS

Branches

Atlanta, Ga.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Butte, Mont.
Chicago, Ill.
Cleveland, O.
Dallas, Tex.
Detroit, Mich.
Denver, Colo.
Duluth, Minn.
El Paso, Tex.
Houghton, Mich.
Joplin, Mo.
Knoxville, Tenn.
Los Angeles, Calif.
New York, N. Y.
New Orleans, La.
Philadelphia, Pa.
Pittsburgh, Pa.
Pottsville, Pa.
San Francisco, Calif.
Salt Lake City, Utah
Scranton, Pa.
Seattle, Wash.
St. Louis, Mo.
Washington, D. C.

See other issues of this periodical for our display advertisement.

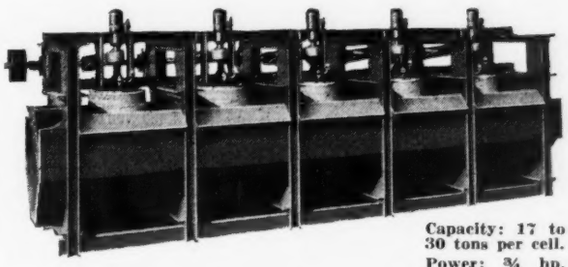
Request complete literature.

INGERSOLL-RAND COMPANY-11 BROADWAY NEW YORK CITY
Offices in principal cities the world over
FOR CANADA REFER-CANADIAN INGERSOLL-RAND CO. LIMITED 260 ST. JAMES STREET MONTREAL QUEBEC.

Ingersoll-Rand

KRAUT FLOTATION MACHINE uses only $\frac{3}{4}$ hp. per cell

Power economy is but one of the several desirable features of this new development. It has enormous aeration capacity; always uniform in all cells; perfect circulation of pulp; no blowers, air pipes, valves, etc.; automatic control; extraordinary low initial cost per ton capacity, with low maintenance and operation; is well adapted for preferential flotation.

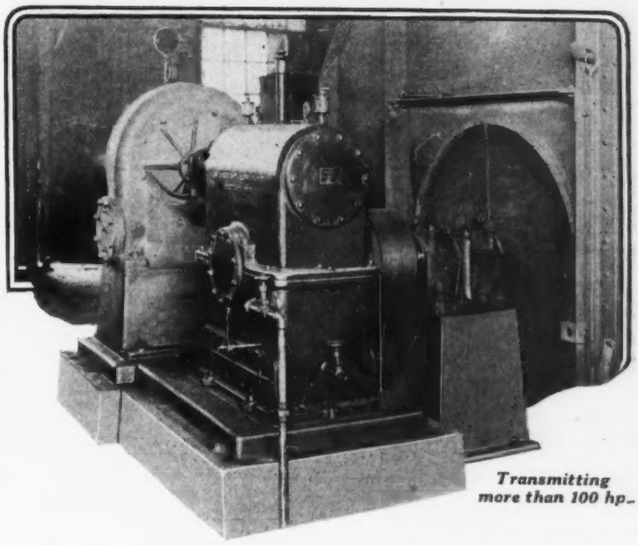


Built in any capacity

Capacity: 17 to 30 tons per cell.
Power: ¾ hp. per cell.
Floor Space: 9 sq. ft. per cell.

A test on your ore may give surprising results. Write for further details.

BUNTING IRON WORKS
Manufacturers of Mining Equipment
First National Bank Bldg., SAN FRANCISCO, CAL.



Transmitting more than 100 hp.

Making possible the use of turbines for low speed equipment!

It is immediately apparent that here is something quite different from the old style of worm gearing. First, the worm speed is about four times greater than was formerly thought to be safe. Second, the power transmitted is reasonably high for a single set of gearing—and the drive is in continuous 24-hour service.

Thus mines and smelters can advantageously use waste heat steam for many driving purposes that heretofore have been unavailable.

Not only that, but the Cleveland Reduction Unit makes it possible to use high speed motors on all equipment—and the savings thus effected more than pay for the installation.

Our engineering department has a wealth of data on actual performances of our Reduction Unit. Consult them for information on driving conveyors, grizzlies, magnetic pulleys, dryers, flotation tables and other equipment. *Write to Department EM.*

CLEVELAND
WORM & GEAR COMPANY
CLEVELAND ~~ ~~~~ OHIO

"Hercules" (Red Strand) Wire Rope

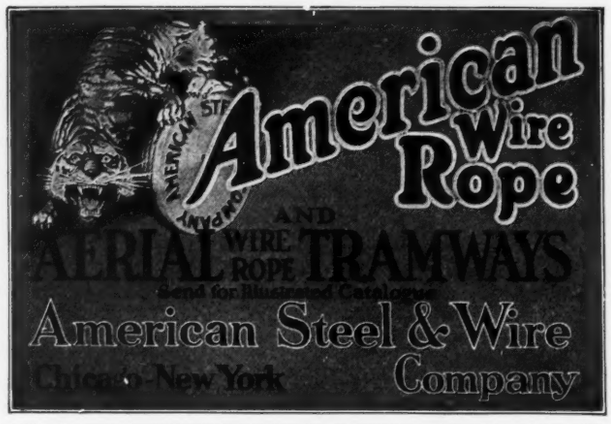
is backed by a long service record. It has actually proven that it is an economical rope for heavy work of all kinds.

Made Only By

A. Leschen & Sons Rope Company

St. Louis

New York Chicago Denver San Francisco



COMBUSTION ENGINEERING CORPORATION

PULVERIZED FUEL

45 BROAD STREET, NEW YORK

THE MILWAUKEE CRANE

"THE MILWAUKEE CRANE"

for continuous operation, safety, strength and durability

Entirely oil lubricated; bearings self-oiling, protected against dirt and grit; enclosed gears running in oil.

Send for our fifty-page illustrated catalog

Milwaukee Electric Crane & Mfg. Corp., Milwaukee, Wis.

ROTARY CAR-DUMPERS FOR MINE CAR

Rotary Dumpers for Railroad Cars

Car Control and Caging Equipment

Trip Control Devices

CAR-DUMPER & EQUIPMENT CO.

Skip Loading Gates

The "Solidcar" Self-Dumping Cage

The Mechanical Mine Car Spragger

Grand Crossing—CHICAGO Westinghouse Bldg.—PITTSBURGH

CARS—HAND, AUTOMATIC AND AIR DUMP CARS—TRACK ETC.

FOR ALL ENGINEERING AND INDUSTRIAL USES.

KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.

KOPPEL — PENNA.

NEW YORK - CHICAGO

PITTSBURGH - SAN FRANCISCO

KOPPEL KOPPEL

ATLAS STORAGE BATTERY LOCOMOTIVES

For Main Line, Surface, and Gathering Work

The Atlas Car & Mfg. Co., Cleveland, O.

MT. VERNON MINE CARS

Cars of every description—Wheels, Castings, Forgings.

Full details on request.

MT. VERNON CAR MFG. CO.

Mt. Vernon, Ill.

One-Fifth The Weight of Cast Iron Pipe

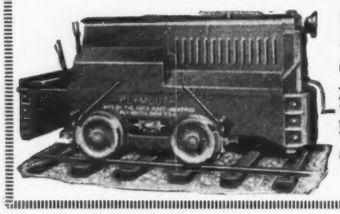
One-Third The Weight of Wrought Pipe

An Absolutely Tight Durable Pipe

Fully 50% stronger than Straight Riveted Pipe of equal thickness. Light weight and simplicity of bolted connections results in low handling and installation expense. Suitable for Conveying Water, Air, Gas, Exhaust Steam and Wood Pulp.

Abendroth & Root Mfg. Co. Sales Office: Woolworth Bldg., N. Y.

Pipe Specialists Continuously Since 1867



PLYMOUTH

Gasoline Locomotives

For mine use and general industrial haulage. Made in 3 to 20 ton sizes and in any track gauge. Write for Catalogs and Performance Bulletins.

THE FATE-ROOT-HEATH CO.

Plymouth, Ohio

Positive Volumes of Air or Gas

ROOTS Rotary Blowers and Gas Pumps positively deliver definite volumes of air or gas at low power cost and practically no upkeep cost. Ask about ROOTS Rotary Pumps and Vacuum Pumps, Gas Meters, Cupola Charging Hoist, Blast, Gates, etc.

A valuable book "ENGINEERING TABLES," will be mailed free.

Ask for Bulletin 118M.

THE P. H. & F. M. ROOTS CO.

Chicago Connersville, Ind. New York

MANCHA'S LITTLE TRAMMER

THE MULTI-LEVEL LOCOMOTIVE

No larger than a mine car.

MANCHA STORAGE BATTERY LOCOMOTIVE CO.,

1909 So. Kingshighway, ST. LOUIS, MO.

Taylor Spiral Riveted Pipe

Forge Welded Pipe

Forged Steel Pipe Flanges

Boiler Nozzles

Flexible Ball Joints

AMERICAN SPIRAL PIPE WORKS

Box 485, Chicago, Illinois New York: 50 Church Street

ALLIGATOR

TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

JUST like driving nails. Makes a smooth hinged joint famous for long service and with great reserve strength.

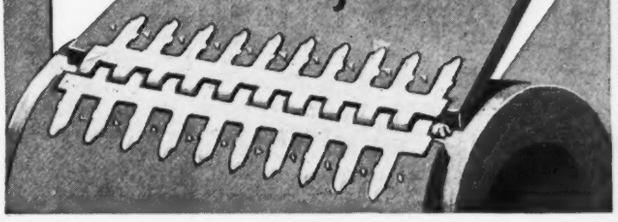
Teeth penetrate lengthwise and clinch down flat in a vise-like grip of steel. No punched holes or internal friction to weaken belt ends.

Easily taken apart if belt is to be lengthened or shortened; just relax tension and push out the steel pin.

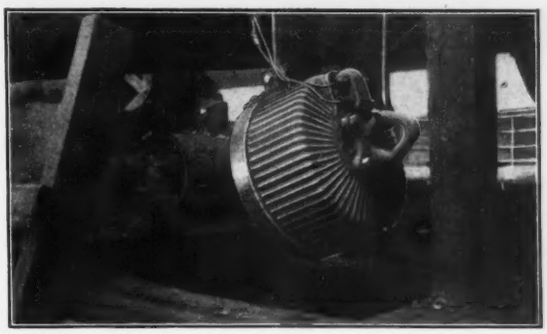
Used and recommended wherever a belt will give efficient service.

Flexible
Steel Lacing Company
4638 Lexington Street
Chicago, Ill.
In England at 135 Finsbury Pavement London, E.C. 2

For Every Size and Kind of Belt



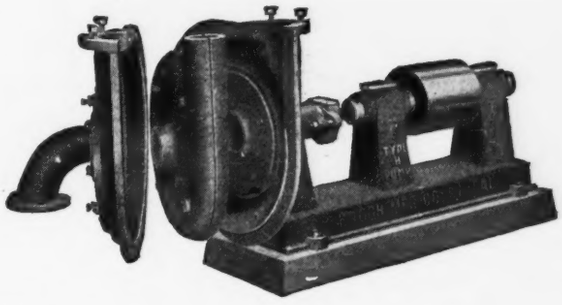
ACCIDENT INSURANCE



EC&M Separator Magnets are your insurance that tramp iron in materials in process will not damage your crushing rolls, pulverizers or similar machines.

Ask us to send you the leaflet that pictures how EC&M Separator Magnets are being used in various industries to remove tramp iron from crushed stone, coal, ore, cinders, clinkers and the like.

The Electric Controller & Mfg. Co.
2700 E. 79th St.
CLEVELAND, OHIO



Krogh *Sand Pumps*

Renewable liners and impellers of special chilled car-wheel iron (so hard that tool steel will not machine them) are important factors in the long life and economy of KROGH sand pumps.

Made in five standard sizes. All sizes operate at low speeds.

Catalog No. 79 Describes and Illustrates Them.

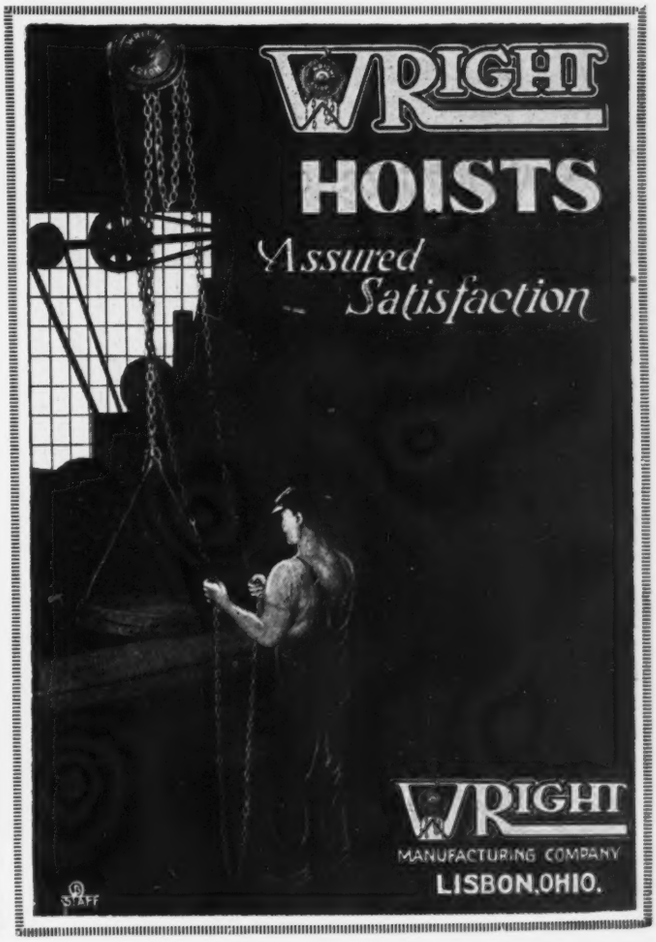
Partial List of Users

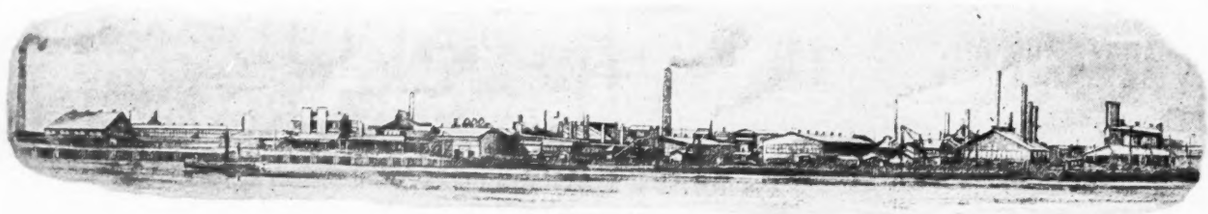
Anaconda Copper Mining Co.
Alaska Treadwell Gold Mining Co.
Alaska Juneau Gold Mining Co.
Alaska Gastineau Mining Co.
Arizona Copper Co.
Beatson Copper Co.
Braden Copper Co.
Butte & Superior Mining Co.
Cananea Consolidated Mining Co.
East Butte Copper Mining Co.
Mexican Corporation
Mond Nickel Co.
Miami Copper Mining Co.

Krogh Pump & Machy. Co.
147 Beale St., San Francisco

We are also manufacturers of Sinking Pumps — Centrifugal Pumps—Motor Driven Pumps and Dredge Pumps.

Catalogs sent on request.





Buyers of
Ores—Concentrates—Lead Bullion—Dore Bullion—Residues
Containing
Gold—Silver—Platinum—Copper—Lead
BALBACH SMELTING AND REFINING COMPANY
Works: Newark, N. J. *Established 1852* Offices: Newark, N. J.—280 Broadway, N. Y.
For full information and prices address
BALBACH METALS CORPORATION
280 Broadway, New York

Bartlesville Zinc Co.
Bartlesville, Okla.

ZINC

Blackwell Zinc Co.
Blackwell, Okla.

Prime Western and Brass Special

Sole Agents:

THE AMERICAN METAL COMPANY, LIMITED
61 Broadway, New York

American Zinc & Chemical Company

Works: Langeloth, Pa.
Office: Oliver Bldg. Pittsburgh

Producers of
Zinc

Prime Western and Brass

Zinc Sulphate Zinc Dust Salt Cake
Nitre Cake Sulphuric Acid
Coal

Buyers of Zinc Ores

SOLE AGENTS
The American Metal Co., Ltd.
61 Broadway, New York

ASSAYERS & REFINERS

Specialists in
Palladium PLATINUM Iridium
Rhodium Ruthenium Osmium
Gold and Silver

PLATINUM SCRAP PURCHASED

BAKER & CO., INC.

Refiners and Workers of Platinum, Gold and Silver
54 Austin St., Newark, N. J.
30 Church St., New York 5 S. Wabash Ave., Chicago

M. LISSAUER & CIE.
Cologne (Germany)

Branch Offices in Berlin, London, Vienna, Paris, Milan
WORKS: Harburg-Hamburg, Trotha, Beuel

Buyers of
METALS and ORES
COPPER — LEAD — ZINC

CORRESPONDENTS IN NEW YORK:
Associated Metals & Minerals Corporation
100 East 42nd Street

UNITED STATES SMELTING REFINING & MINING COMPANY

55 Congress Street, Boston, U. S. A.

BUYERS OF

Gold, Silver, Lead and Copper Ores; Lead and Zinc Concentrating Ores; Matte and Furnace Products.

REFINERS OF LEAD BULLION
PRODUCERS AND SELLERS OF

Gold, Silver, Lead, Copper, Arsenic, Insecticides, Fungicides, and Cadmium and Coal.

SELLING OFFICES: 57 WILLIAM STREET, NEW YORK

Operating Offices:

912 Newhouse Bldg., Salt Lake City, Utah; Eureka, Colo. (Sunnyside Mining & Milling Co.); Pachuca, Mexico (Real del Monte Co.); Fairbanks, Alaska (Fairbanks Exploration Co.); Nome, Alaska (Hammon Consolidated Gold Fields).

Exploration Offices:

For examination and purchase of mines and mining properties, 55 Congress St., Boston, Mass. District Offices: 120 Broadway, New York; 1504 Hobart Bldg., San Francisco, Calif.; Newhouse Bldg., Salt Lake City, Utah.

American Smelting & Refining Co.

Member of Copper and Brass Research Association

Buyers of

All non-ferrous Bullion, Ores, Concentrates, Mattes and Blister

Producers and Sellers of

GOLD	BISMUTH	TELLURIUM
SILVER	CADMIUM	TEST LEAD
COPPER	CADMIUM SULPHIDE	THALLIUM
LEAD	C. P. LITHARGE	ZINC DUST
ZINC	NICKEL SALTS	ZINC CHLORIDE
ARSENIC	SELENIUM	ZINC SULPHATE

SALES OFFICE: 120 BROADWAY, NEW YORK

Manufacturers of

LEAD SHEETS AND PIPE
BABBITTS AND SOLDERS
QUAKER GIRL PIGMENT AND PAINT
COPPER SULPHATE AND ZINC SULPHATE

Address inquiries to

American Smelting & Refining Co.
444 California St., San Francisco, Cal.

COPPER WIRE, RODS, SHEETS AND ROLLS.

Address inquiries to

Baltimore Copper Smelting & Rolling Co.
Baltimore, Md.

Distributors, Mexico and Southwestern U. S.

Cia Comercial, S. A. 317 No. Oregon St., T. D. Roche, Gen. Mgr., El Paso, Texas.

Warehouses: El Paso, Texas; Phoenix and Tucson, Arizona; and Mexico City, Chihuahua City, Parral, Torreon, Rosita and Saltillo, Mexico.

Irvington Smelting & Refining Works

Formerly Glorieux Smelting & Refining Works

Buyers, Smelters and Refiners of

Gold, Silver, Lead, Copper and Platinum Ores, Sweeps and Bullion

Manufacturers of Copper Sulphate

Irvington, New Jersey

Lehigh Valley R. R. connection

New York Office:

CHARLES ENGLEHARD, Hudson Term. Bldg., 30 Church St.

Illinois Zinc Company

Manufacturers of

Corrugated Zinc Sheets

An ideal long-life covering for mill and smelter buildings

Producers of rolled zinc in all forms
Selected Brass Special Slab Zinc
Sulphuric Acid

Buyers of High Grade Zinc Ore

OFFICES:

1028 McCormick Bldg. Chicago — Plant, Peru, Ill. — 2 Rector Street New York

COPPER

(ELECTROLYTIC)

BRANDS: "LNS" and "Triangle Special"

Made and Sold by the

NICHOLS COPPER COMPANY

Sole Owners and Distributors of the
NICHOLS-HERRESHOFF (Air Cooled) FURNACE
For Roasting and Calcining ores

Sales Office: 25 Broad St. — Cable Address: "Triangle" — Refinery: Laurel Hill

NEW YORK

FOREIGN REPRESENTATIVES

Société des Minerals et Métaux. 88 Rue de Courcelles. Paris, France.

Société Générale des Minerals. 31 Rue du Marais. Brussels, Belgium.

ZINC

Sheets, in all sizes and gages
Ribbon in coils, in all gages
Plates, rolled to specifications
Shapes, squares, oblongs and circles cut to specifications
Slab, "M & H" choice brass
Perforated, to meet Mexican Customs Laws, for Cyanide Process
Roofing, corrugated sheets and shingles

Sulphuric Acid

MATTHIESSEN & HEGELER ZINC CO.

Offices and Works: La Salle, Ill. — Eastern Office: 111 Broadway, New York

INCO Nickel

—shot, ingot, electrolytic 99.8% rods and sheets.

MONEL METAL

—castings, shot, ingot, rods, sheets and forgings.

THE INTERNATIONAL NICKEL COMPANY
67 Wall Street, New York

New York Engineering Co.

2 Rector Street, New York

Empire Gold Dredges and Prospecting Drills

SINTER YOUR FINE ORES

Special Problems in Ore Treatment

DWIGHT & LLOYD SINTERING CO., Inc.

29 Broadway, New York City
Cable Address: "Sinterer—New York"

MANGANESE STEEL

THE FIRST ERA STILL LEADS IN QUALITY

Steam Shovel Parts
Crusher Parts
Ball and Tube Mill Parts
Conveyors, Chain and Sprocket
Gears and Pinions

THE ERA STEEL CO.
Bucyrus, Ohio

THE BRAUN CORPORATION

ASSAY SUPPLIES

Los Angeles, California, U. S. A.

PHELPS DODGE CORPORATION

99 JOHN STREET, NEW YORK

"C★Q" ELECTROLYTIC **COPPER** "P.D.Co." CASTING

Members of Copper Research Association

TRY IT SOME CONVENIENT OPPORTUNITY

MANGANESE STEEL

Any reliable manufacturer can supply it. You will be surprised at the gratifying results.

TAYLOR-WHARTON IRON & STEEL CO.
High Bridge, N. J.

The ACME MAGNETIC PULLEY

standardized separation

For concentration and refinement and the protection of crushers and grinders

The ACME MAGNETIC PULLEY COMPANY
9 South Clinton Street — Chicago, Illinois

United Metals Selling Company

25 Broadway
New York

Pig Lead—
Desilverized Common and Corroding

International I. L. R. Co.

Electrolytic Zinc
Highest Grade and Purity

Anaconda Electric

Selenium, Arsenic, Nickel Salts
Tellerium, Cadmium
Copper Sulphate

The American Metal Co., Ltd.
61 Broadway, New York

Oliver Bldg.
Pittsburgh, Pa.

Boatman's Bank Bld.
St. Louis

Buyers of
Gold, Silver, Lead, Zinc and Copper Ores.
Copper Matte, Copper Bullion
and Lead Bullion.

Producers of
Gold, Silver, Lead, Zinc
Electrolytic Copper and Casting Copper

Importers of
Tin

International Smelting Company
25 Broadway, New York

Purchasers of
Gold, Silver, Copper
and Lead Ores

Smelting Works
International, Utah Miami, Arizona

Ore Purchasing Department
618 Kearns Building, Salt Lake City, Utah

Refineries
Raritan Copper Works, Perth Amboy, N. J.
International Lead Refining Co., East Chicago, Ind.

United States Metals Refining Co.

New York Office: 61 Broadway

Smelter and Refinery at
CARTERET, NEW JERSEY

Buyers of:
Ores, Mattes, Concentrates, Residues
containing Copper, and or Silver, and or Gold,
Copper Bullion, Black Copper,
Copper and Brass Furnace Materials

Producers of:
Electrolytic Copper, "DRW" Brand
Casting Copper, Silver, Gold,
Platinum, Palladium, Selenium

SEARCHLIGHT SECTION

USED EQUIPMENT & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$4.50 an inch
4 to 7 inches.....4.30 an inch
8 to 14 inches.....4.10 an inch

Rates for larger spaces, or yearly rates, on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

F. &M

EMPLOYMENT SERVICE

EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally planned by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 264 Main Street, Buffalo, New York..

EMPLOYMENT AGENCY

WANTED immediately: chief mine accountant, speak Spanish, experienced large Mexico companies, $300; 7 openings recent graduate mining or civil engineers, large Western mining companies, $125-$140 start; 8 openings recent graduate metallurgical or chemical engineers, Western U. S. and Mexico, $125-$150; graduate mine surveyor, Eastern U. S., $125; flotation millman, Mexico, $150; 6 repair electricians, Western mining company, surface work, $156; converter foreman, Southwest, $6.50 per day; chief chemist, Mexico, $175; assayer-engineer, Mexico, $160; silver refinery man, foreign, $165; flotation experimentalist, Southwest, $175; surveyor-geologist, Alaska, single, $175; mine shift boss, Mexico, single, speak Spanish, $200. Apply Business Men's Clearing House, Denver, Colorado.

POSITIONS WANTED

DRAFTSMAN—Mechanical, experimental, structural maintenance, shop experience. Open for position about July fifteenth. Location Chicago or vicinity. PW-425, Engineering & Mining Journal-Press, 7 So. Dearborn St., Chicago, Ill.

GRADUATE mining engineer, ten years' experience in shaft sinking, tunnelling, topographical and mine surveying, mapping. Eastern states preferred. Address Box 52, Grey Cliff, Montana.

MANAGER or superintendent: Engineer with eighteen years' experience operation, design and construction, United States and Mexico. Experienced in economical development and production. Address, Engineer, 3015 Calle Noguera, Santa Barbara, Calif.

MEXICO, superintendent, 38, at present in Ontario, available at short notice as general superintendent, cyanide superintendent or mine superintendent, speaks Spanish, first-class record, Mexican and Spanish American experience. PW-428, Engineering and Mining Journal-Press, Tenth Ave. at 36th St., New York.

MILL superintendent, specialty lead, zinc, iron separation capable research and testing metallurgist. 15 years' experience. Address Box 368, Midvale, Utah.

POSITIONS WANTED

MINING engineer, technical graduate, 39 with family, employed in foreign country as mine superintendent, seeks connection with responsible parties or company as mining engineer, superintendent or manager. Minimum salary considered to start $5,000 per year. PW-420, Engineering & Mining Journal-Press, Star Bldg., St. Louis, Mo.

MINING engineer. Canadian graduate. 10 years' experience in the field. Open for engagement. Well versed in metallurgy and geology of all Ontario camps. Member of Canadian Mining Institute and Ontario Professional Engineers. Best of references. PW-426, Engineering and Mining Journal-Press, Tenth Ave. at 36th St., New York.

MINING corporation manager, sixteen years' experience as successful manager of large mines, mills and smelters. Have increased output with lower costs, on every large operation handled and have developed prospects to large producers. Technical graduate with thorough knowledge of every phase of mining and refining operations, coupled with unusual executive ability. Immediately available. PW-430, Engineering and Mining Journal-Press, 7 So. Dearborn St., Chicago, Ill.

BUSINESS OPPORTUNITIES

Capital Wanted

Well developed mining property, need capital, complete assay plan and mine report to hand. Property will stand closest examination. Capital needed for mill and machinery. H. Dickman, 1326 Maryland St., Los Angeles, Cal.

First European Special Manufacturers of First Class Compressed Air Engines Want for U. S. A.

REPRESENTATIVE or GROSSIST

who is well introduced to Mines. Detailed offers with respective references, proposals, etc., solicited sub E.N. 5055 to Ala.

Haasenstein & Vogler
Essen, Germany.

SALES ENGINEER

Properties bought, sold or handled on commission. 25 years' experience in Ores, Metals, Minerals, MINES, Oil Lands and Real Estate. Properties inspected, titles investigated, books audited, stock and bond issues placed with brokers and investors. Spanish-American work solicited and given expert attention.

LEMUEL C. BUTLER
26 Water St., Stapleton, New York City.

FOR SALE

Silver—Lead—Zinc Mine

Located in Colorado. 23 claims—67 acres developed and operating. Completely equipped railroad direct to mill. Real proposition for either operator or promotor. *Full particulars on request.*
BO-429, Eng. & Mining Journal-Press
7 South Dearborn St., Chicago, Ill.

Muleback Transportation Machinery

Engines, boilers, crushers, feeders, ball mills, tube mills, thickeners, classifiers and tanks.

ROY & TITCOMB, Inc.
Nogales, Arizona

CRUSHERS

1—Sturtevant No. 1 Rotary Fine Crusher.
1—20x18-in. Webster Toothed Roll Crusher, housing and fly wheel.
2—18x24-in. Crushing Rolls, rolls plain, frame, bearings, take-ups and pulleys.
1—Devore No. 1 Simplex Crusher.
1—Ball Mill Batch Grinder.
1—No. 2B Gardner Crusher.
1—Draver No. 3 Laboratory Crusher.

Our new General Equipment Catalogue shows much material handling equipment. Ask for it.

Nashville Industrial Corporation
Old Hickory, Tennessee

WANTED

Grinding Equipment and Filter Presses

W-418, Eng. & Mining Journal-Press
Tenth Ave. at 36th St., New York City

WANTED

Ball or Rod Mill, also Oliver or American Filter. State size, condition, price and location.

BUTCHART MILLING CO., Joplin, Mo.

An Original and Up-to-date Mining Convention

Drilling contests and other old time Western sports.

THREE BIG DAYS

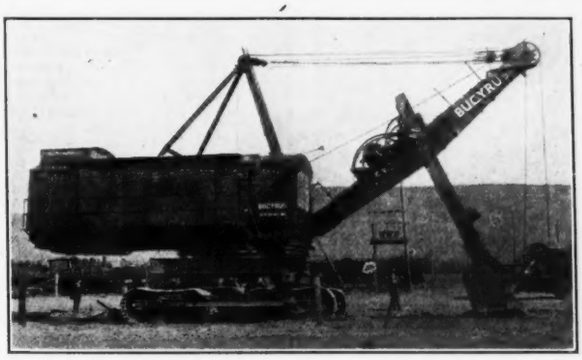
Great possibilities for the

INVESTOR

Mineral exhibit will consist of properties for sale only.

CHAMBER OF MINES OF EASTERN BRITISH COLUMBIA
Box 901, Nelson, B. C.

Electric Shovels at a Bargain



3—Bucyrus Electric Alternating-Current, Full Revolving Shovels, Caterpillar Traction—Model 80-B—2½-yd. Dipper, Boom 32 ft. Dipper Handle 20 ft. Each shovel includes $5,000.00 new repair parts. All shovels in first-class condition. Were used only a short time.

Write for complete specifications.

UNITED COMMERCIAL CO.
234 Steuart St., San Francisco
El Paso Los Angeles Portland Seattle
HYMAN-MICHAELS CO., CHICAGO

Mining & Milling Machinery

Crushers
1—5x7 Denver Quartz Mill.
1—7x10 Blake.
1—7x10 Krom Simplex.
1—7x11 Dodge.
6—9x15 Blake.
2—11x15 Dodge.
1—No. 1 Gates Gyratory.
1—No. 3 Gates Gyratory.

Crushing Rolls
1—Set 10x9-in. McFarlane.
1—Set 20x12-in. Davis.
1—Set 20x12-in. Colo. Iron Works.
1—Set 20x12-in. Denver Eng. Works.
2—Sets 20x12-in. Stearns-Roger.
2—Sets 27x14-in. Colo. Iron Works.
2—Sets 27x14-in. Davis.
1—Set 27x14-in. McFarlane.
2—Sets 30x14-in. Pow. & Mining Machy.
1—Set 36x16-in. Colo. Iron Works.
2—Sets 36x16-in. Davis.
2—Sets 36x16-in. Denver Eng. Works.
3—Sets 40x16-in. Colo. Iron Works.

Tube Mills
1—6x11-ft. Tube Mill, steel lining.
1—6x12-ft. Allis-Chalmers, Silex lining.
2—5½x20-ft. Tube Mills, Silex lining.
5—5½x22-ft. Tube Mills, Silex lining.
5—5x22-ft. Tube Mills, Silex lining.

Ball Mills
1—22x24-in. Ball Mill.
1—5-ft. 6-in.x6-ft. Standard.
1—6x6-ft. Allis-Chalmers.
1—8x4-ft. Krupp.
1—3x3-ft. Standard, New.
2—4x3-ft. Standard. New.
1—4x4-ft. Standard, New.
2—5x4-ft. Standard, New.

The Morse Bros. Machinery and Supply Co.
Phone M-5300
Broadway at Brighton Blvd., Denver, Colo.
2

CRUSHING ROLLS

1—Set McFarlane and Eggers 27x14-in. Price, F.O.B. Yucca, Arizona, $900.00.

MACHINERY SALES AGENCY
760-762 Folsom St., San Francisco

USED MACHINERY

Compressors, Hoists, Motors, Engines, Crushers, Mills, etc., carried in our store in San Francisco.

Pay cash for good plants.

U. S. MACHINERY & STEEL CO.
750-752 Folsom Street. Doug. 7468.

CRANES
3—20-ft. swing, Foundry jib cranes, complete with motors.
2—30-ft. span, 10-ton electric travelling cranes.

DERRICKS, STIFF LEG
2—Sets 14-in. American derrick irons, complete bronze bushed sheaves, bull wheel, etc.
1—Set 18-in. American derrick irons, complete.

DERRICKS, GUY
1—All steel guy derrick, 75-ft. boom, bull wheel, and all irons, complete.
1—Set 8-in. Standard derrick irons.
1—Set 10-in. Standard derrick irons.
1—Set 12-in. American derrick irons.
1—Set 14-in. American derrick irons.

CARS, DUMP
12—4-yd. Western dump cars, 36-in. gauge.

CARS, FLAT
3—36-in. ga., 26-ft. long flat cars.

CARS, GONDOLA
28—36-in. ga., gondola cars.

CARS, TANK
18—General American Tank Car Co., 4300 gal. to 8,000 gal., 5x5 couplers, Westinghouse air brakes, standard gauge.

THE DENVER METAL & MACHINERY CO.
Denver, Colo.
(1)

Ore Cars

Immediate Shipment

Standard gage, 100,000 lbs. capacity. All steel, self-clearing, hopper bottom.

Cars 20 ft. long, 663 cu. ft. capacity.
Cars 22 ft. long, 1028 cu. ft. capacity.
Cars 24 ft. long, 1100 cu. ft. capacity.
Cars 30 ft. long, 1500 cu. ft. capacity.

Suitable for handling ores, rock, gravel, sand, coal, or other bulk materials. Wire or write for specifications and prices. Also in stock flat cars, flat bottom gondola cars, cabooses. Large stocks new and relaying rails.

Hyman-Michaels Co.

Peoples Gas Building
CHICAGO, ILL.
St. Louis San Francisco Portland Seattle
Dallas Los Angeles

MINING and SMELTER EQUIPMENT

Standard makes in excellent condition, ready for immediate delivery—Prices right.

COPPER CONVERTERS
1—Allis-Chalmers 72x100-in.
2—Allis-Chalmers 96x150-in.

BLOWERS
7—Connersville Pressure Blowers, capacity 15,000 cu. ft. at 42-ounce pressure.
1—Nordberg Blowing Engine, Twin Cylinder, 15,000 cu. ft. capacity at 15 lb. pressure. Rope Transmission Drive from 750 hp. motor.
2—American Exhaust Fans, Sirocco. 5-ft. wide x 12-ft. dia. with 2-8-ft. intakes and 6-ft. discharge.
1—Sturtevant Blowing Fan, Sirocco Type. 5-ft. wide x 10-ft. dia. with 2-8-ft. intake and 6-ft. discharge.

BRIDGE CRANES
2—50-ton Morgan with two 15-ton auxiliaries—50-ft. span, 5 motor type.
1—30-ton Northern with one 10-ton auxiliary, 35-ft. span, 4 motor type.
1—15-ton Northern—48-ft. span—hand operated.

LOCOMOTIVES
Electric Haulage
36-in. gauge, 500 volt, D.C.
3—4½ ton Westinghouse
1—4½ ton General Electric.
2—6½ ton Westinghouse.
1—6 ton General Electric.
1—8½ ton Westinghouse.
1—13 ton General Electric.
3—13½ ton General Electric.
2—25 ton Atlas.

Send for complete stock list

UNITED COMMERCIAL CO.
234 Steuart St., San Francisco
El Paso Los Angeles Portland Seattle
Hyman-Michaels Co., Chicago

NEW AND REBUILT
Mining and Milling Machinery

Send for Complete List

Agents for:
Allingham Flotation Machines

ROSENBURG & CO. MINING MACHINERY LOS ANGELES
Rosenburg & Co.

3rd & San Pedro Sts. Los Angeles, Cal.
8th, Madison & Jackson Sts. Phoenix, Arizona

CRUCIBLES

2—Monarch Steel Harvey Crucibles No. 60. Portable, tilting, stationary.

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee.

SHOP TOOLS

1—Fairbanks-Morse Tool & Trip Hammer No. 1244. Belt Drive.

1—28-in. Upright Drill Press, M'g. by W. F. & J. Barnes Co.

1—Hammer Core Machine, for making cores from ⅝-in. to 7-in.

1—30-in.x18-in. Lodge & Shipley Patented Head Lathe, complete, direct connected to 15 HP., 400-800 R.P.M., 200 V., D.C. Motor.

1—Marvel Draw Cut Hack Saw No. 2.

1—Pacific Electric Welder. Capacity two ¼-in. sheets.

1—Cox & Son Pipe Machine No. 305, belt drive. Cuts 1-in. to 6-in. pipe.

1—Oxweld Acetylene Generator, size 50, capacity 50 cu.ft. per hour.

TRANSMISSION

1—No. 0, Class "G" range 2 to 1 Variable Speed Transmission.

2—No. 5, Class "C", range 6 to 1 Variable Speed Transmission.

SAND BLAST MACHINE

1—Type AC-6 Pangborn Sand Blast Machine.

ORE SAMPLES

2—Ore 30-in. dia. revolving samplers, 4 cuts per revolution.

1—Barrel Sampler, with extra barrel and cutter.

Send us your inquiries for concentrating machinery, crushers, and other items of mining and milling equipment.

MERCHANDISING DEPT.
KEARNS BUILDING · SALT LAKE CITY, UTAH

UTAH COPPER COMPANY
BUTTE & SUPERIOR MINING CO.
RAY CONSOLIDATED COPPER CO.
NEVADA CONSOLIDATED COPPER CO.

Save Time and Money on

Mining and Milling Machinery

1—Denver Engineering Works Ball Mill, 5x12-ft., complete with clutch pulley.

1—Hardinge 6-ft.x22-in. Conical Ball Mill.

1—Marcy 32 Ball Mill.

1—May 5x5-ft. Ball Mill.

1—Set Colorado Iron Works Improved Type Crushing Rolls, size 36x16-in.

1—Colorado Iron Works Blake Type Jaw Crusher, size 9x15.

1—Blake Type Jaw Crusher, size 10x20.

1—Allis-Chalmers Blake Type Jaw Crusher, size 18x30.

1—8x8-ft. Oliver Continuous Filter, complete with Doak Vacuum Pump and receiver.

1—8x8-ft. Portland Continuous Filter, complete.

1—50x8-ft. Dorr Thickener Mechanism, complete with redwood tank, 3-in. staves.

1—Model "C" Dorr Duplex Classifier, size 4-ft. 6-in.x14-ft. 8-in.

1—Heavy Duty Model "C" Dorr Duplex Classifier, size 6x20-ft.

3—4 Compartment Harz Jigs, complete.

3—3 Compartment Harz Jigs, complete.

2—2 Compartment Harz Jigs, complete.

1—Dewco Double Drum Electric Hoist, 5000 lb. rope pull, complete with 75 hp. Westinghouse, 440 volt Hoist Motor.

1—Vulcan Double Drum Electric Hoist, 9000 lb. rope pull, complete with 250 hp. Westinghouse, 2200 volt Hoist Motor.

1—Chicago-Pneumatic Compressor, Type OCB, size 15x9x10, complete with motor and short belt drive.

Large stock of Motors, Transformers and Pumps, all kinds and sizes.

"SERVICE AND QUALITY AT A SAVING IN COST"

Eastern Iron & Metal Co.

634 So. 4th West St., Salt Lake City, Utah

BOILERS

10—823 HP. Babcock & Wilcox Stirling Water Tube Boilers, Class M-30, 200 lbs. pressure. Westinghouse Stokers, forced draft fans, Vulcan soot blowers and all accessories. Used less than three months.

5—400 HP. Wickes Vertical Water Tube Boilers, 175 lbs. pressure. Murphy Stokers, 48-in.x90-ft. steel stacks. All accessories.

1—300 HP. Vogt Water Tube Boiler, 125 lbs. pressure.

2—300 HP. Heine Water Tube Boilers, 160 lbs pressure.

Nashville Industrial Corporation
Old Hickory, Tennessee.

FOR SALE—PIPE LINE
And Pumping Plant

2—Miles 3-in. std. Blk. pipe.

1—3x6 Goulds Triplex Pump Fig. No 1373, 30 GPM, 1000 ft. head.

1—25 hp. Fairbanks Morse Type KBV, 440 volt, 3 phase, 60 cycle, 900 r.p.m. motor, Internal Starter type for remote push button control.

Also 309 cu. ft. Oil Driven Compressor, 5x16 Tube Mill practically new with El Oro Liners.

Address
MACHINERY SALES AGENCY
Winnemucca, Nevada

TO HELP YOU

LOCATE SELLING OPPORTUNITIES

"Searchlight" Advertising

G-6

Blowers *Exhausters*

The Connersville Blower Co.

Connersville, Ind.

Boosters *Pumps*

HOISTS
SKIPS-CAGES-TIPPLES

WELLMAN-SEAVER-MORGAN-Co. CLEVELAND, O.

Trolley Supplies, Rail Bonds
Porcelain Insulators

The Ohio Brass Company
MANSFIELD, OHIO

CARBIDE TP IT'S TROUBLE-PROOF LAMPS

DEWAR MANUFACTURING CO.
26-32 THIRTY-FIFTH STREET
BROOKLYN, N. Y.

OTTUMWA IRON WORKS
OTTUMWA, IOWA

Manufacturers of
Electric and Steam Hoisting Engines and Mine Equipment

Ottumwa Patent ROLLER BEARING TRUCKS
For Mine and Industrial Cars

THE SEARCHLIGHT SECTION

will locate the Man you want
Position you want
Equipment you want

Are you using the Searchlight?

PROFESSIONAL DIRECTORY

$20.00 for 3 Lines or Less. $5.00 for Each Additional Line. Subscription $5.00.

A

Adams, Huntington, Mining Engineer, c/o Patino Mines and Enterprises Consolidated. Oruro, Bolivia. Cable: Hadam, Oruro.

Addicks, Lawrence, Consulting Engineer, 51 Maiden Lane, New York City. Cable: Galie, New York.

Aldape, Garza, J. M., E. M., M. E., Consulting Geologist and Mining Engineer. Examination and Management of Properties. P. O. Box 229, Torreon, Coahuila, Mexico.

Adler, Joseph L., Consulting Geologist, 1115 First National Bank Bldg., Denver, Colo.

Aldridge, Walter H., Mining and Metallurgical Engineer. 41 East 42nd St., New York.

Allied Engineers, Ltd., A. K. Knickerbocker, H. I. Pearl, E. R. Cullity. Examinations, Exploration and Management. Crosby, Minn.

Ambruster, H. W., Consultant, Arsenic, Calcium Arsenate. Insecticides; Sup., Plt. Construction. Marketing. Cable: Ambruschem, 261 Bway., N. Y.

Andrews, Worth B., Mining Engineer. Texas National Bank Bldg., Fort Worth, Texas. Code: Bedford-McNeill.

Austin, Wilson & Gamble, Mining Engineers. 316 Kohl Bldg., San Francisco. Cable: Austin. Usual Codes.

B

Ball, C. Leonard, Director General Mining Dept. of Bolivian Gov't. Cable: Lenball. Casilla 696, La Paz, Bolivia.

Ball, Sydney H., Mining Geologist. 42 Broadway, New York. Cable: Alhasters. Rogers, Mayer & Ball.

Balliet, Letson, Consulting Engineer. Tonopah, Nevada and 311 American Bank Bldg., Oakland, Cal.

Bancroft, Howland, Mining Geologist and Engineer. Lago Petroleum Corp., Apartado 172, Maracaibo, Venezuela. Cable: Howban. Code: Bedford McNeill.

Banks, Charles A., Mining Engineer. 612 Pacific Bldg., Hastings St. W., Vancouver, B. C. Cable: Bankca. Code: Bedford-McNeill.

Banks & Son, John H., Mining Engineers and Metallurgists. 26 John St., New York. Cable: "Metbanks."

Barry, John G., Mining Geologist and Engineer. Explorations. Examinations, Development, Geol. and Top. Maps, Sections. Mexico specialty. Mills Bldg., El Paso, Tex., c/o A. S. & R. Co.

Beatty, A. Chester, Consulting Mining Engineer, 25 Broad St., New York. No professional work entertained. Cable: Granitic.

Beauchamp, F. A., Metallurgist. Specialty: Flotation. Chancery Bldg., 564 Market St., San Francisco.

Bedford, Robert H., Mining Engineer. Grass Valley, California.

Bell, Charles N., Consulting Mining Engineer. 829 Symes Bldg., Denver, Colorado.

Bjorge, Guy N., Mining Geologist. 1400 Hawthorne Terrace, Berkeley, Cal.

Boise, Charles W., Mining Engineer. Foreign Exploration. Room 1507, 14 Wall St., New York. Cable: Mukeba.

Botsford, C. W., Consulting Mining Engineer and Geologist. Inspiration, Arizona.

Botsford, R. S., Mining Engineer. 8919 Sutphin Blvd., Jamaica, L. I., U. S. A.; 256 Gresham House, London, England.

Brodie, Walter M., Mining and Metallurgical Engineer. 1807 Phelps Place, Washington, D. C.

Brown, R. Gilman, Consulting Engineer. Adelaide House, King William St., London E. C. 4. Cable: Argeby, Usual Codes.

Browne, Spencer C., Mining Engineer. 2 Rector Street, New York. Cable: Spenbrowne, New York.

Burch, Albert, Mining Engineer. Black Oak Ranch, Medford, Oregon. Cable: Mineng, Medford, Oregon.

Burch, Hershey & White, O. H. Hershey, Lloyd C. White. Consulting Mining Engineers. Crocker Bldg., San Francisco, Cal. Cable Address: Burch, San Francisco. Usual Codes.

Burch, H. Kenyon, Consulting Engineer. 576 Chamber of Commerce Building, Los Angeles, Cal.

Burlingame, Walter E., Mining Engineer and Metallurgist. 1915 Lawrence St., Denver, Colo.

Burns, William, Mining Engineer, Apartado 63, Bogota, Colombia, S. A. General Telegraph Code. Cable Address: Wimburns Bogota.

Burrall, Frederick P., Mining Engineer. Longyear Bldg., Marquette, Michigan.

C

Calkins, F. E., Mining Geologist and Engineer. Globe, Arizona.

Callow, J. M., Pres. General Engineering Co. Consulting Metallurgical Engineers. Room 1242, 50 Broad St., New York. 159 Pierpont St., Salt Lake City, Utah, U. S. A.

Chance & Co., H. M., Coal and Iron Mining Engineers. 839 Drexel Bldg., Philadelphia.

Channing, J. Parke, Consulting Engineer. 61 Broadway, New York.

Chase, Charles A., Mining Engineer, 777 William St., Denver, Colo.

Chèdé, L. Ingenieur Des Mines. Long experience Colombian properties, Examinations, Reports, Purchases. Cali, Republic of Colombia.

Clapp, Frederick G., Consulting Geologist. Suite 1351, 50 Church St., New York City.

Cohen, Samuel W., Consulting Mining Engineer. Dominion Express Bldg., Montreal, Canada.

Cole, F. L., Mining Engineer. 98 Bulvarny Prospect, Harbin, Manchuria, China. Cable: Amrustraco.

Collbran, Arthur H., E. M., Consulting Mining Engineer, Seoul, Chosen, (Korea).

Collins, George E., Mining Engineer, Consultation; Examinations; Management. Boston Bldg., Denver, Colo. Cable: Colcamac.

Constant Co., C. L., Mining, Metallurgical and Chemical Engineers, New York Office, 220 Broadway, New York, N. Y. Cuban Office, Amargura 23, Havana, under J. C. Porter. Registered Mining Engineer under Cuban law.

Copeland, Durward, Metallurgical Engineer. Casilla 53, Oruro, Bolivia, South America.

Corless, George B., Geologist and Mining Engineer, 302 North Wall St., Joplin, Mo.

Cranston, Robert E., Mining Engineer, 61 Broadway, New York City. Cable: Recrans.

D

Dahl, S. K., Mechanical and Milling Engineer. Testing Ores. Designing and Building Mine Plants and Mills. Central Bldg., Los Angeles, Cal.

Demming, Henry C., Mining Engineer, Geologist, Mineralogist and Chemist. Offices and Laboratory, 1152 Mulberry St., Harrisburg, Penn.

Dickerman, Nelson, Mining Engineer. The Insurance Exchange, San Francisco. Cable: Deerhodor. Code: McNeill 1908.

Dorr, John V. N., President. The Dorr Co., Metallurgical and Chemical Engineers. Investigations, Plant Design. 247 Park Ave., New York.

Draper, Marshall D., Mining and Metallugical Engineer. Detwiler Bldg., Pershing Square, Los Angeles, Cal. Code: Bentley.

Drew, C. V., 2nd Vice-Pres., Cerro de Pasco Copper Corporation, 15 Broad St., New York. No outside professional work accepted.

Dudley, H. C., Mining Engineer, 704 Lonsdale Bldg., Duluth, Minn.

Dwight, Arthur S., Mining Engineer and Metallurgist. 29 Broadway, New York. Cable: Sinterer. Code: McNeill; Miners & Smelters.

E

Easley, George A., Mining Engineer. La Paz, Bolivia, S. Am. 198 South St., Morristown, N. J. Cable: Address: "Easley," La Paz.

Ede, J. A., Consulting Mining Engineer, La Salle, Illinois.

Elliott, Roy H., Mining Engineer, 713 Mechanical Institute Bldg., 57 Post St., San Francisco, Calif.

Elmer, Wm. W., Consulting Mining Engineers. Examinations. Reports, Administration. U. S. Nat. Bank Bldg., Portland, Oregon.

Emery, A. B., Mining Engineer. Messina, Transvaal. Tele. and Cable Address: Abemery, Messina, Transvaal.

Emlaw, H. S., Mining Engineer. 233 Broadway, New York City.

Erdlets, Jr., Joseph F. B., Mining Engineer, 25 Broadway, New York. Cable Address: Branderlet, New York.

Ettlinger, I. A., Consulting Mining Geologist and Engineer. Examinations, development and geologic maps. Microscopic examination of rocks, ores and sands. Rm. 1813, 149 Broadway, N. Y.

F

Farish, George E. Con. Mining Engineer, 25 Broad St., N. Y. Permanent European address c/o Muguay & Co., Bankers, Florence, Italy.

Farish, John B., Mining Engineer. No professional work accepted. Address: Apt. 703, 850 Powell St., San Francisco, Cal. Cable: Farish.

Fay, C. A., Mining Engineer, Wallace, Idaho.

Ferrier, W. F., Consulting Mining Engineer and Geologist, 87 Harper Ave., Toronto 5, Ont., Canada.

Ferron, Robert D., Consulting Mining Engineer, Casila 27-A, La Paz, Bolivia. Cable: Ferron La Paz.

Finch, John Wellington, Mining Geologist and Engineer. 707 First National Bank Bldg., Denver, Colo.

Finlay, J. R., Mining Engineer. Room 1410, 170 Broadway, New York.

Fitch Company, Walter Jr., Shaft and Tunnel Contractors. Eureka, Utah.

Fisher & Lowrie, Consulting Geologists and Fuel Engineers. 1st Nat'l Bank Bldg.,, Denver, 170 B'way, N. Y. Cable: Califishoil. Usual Codes.

Flagg, Arthur Leonard, Consulting Engineer. 306 Goodrich Bldg., Phoenix, Arizona.

Fohs, F. Julius, Oil Geologist, 51 East 42nd St., New York City. No professional work undertaken.

Fowler, Samuel S., Mining Engineer and Metallurgist. Nelson, British Columbia. Cable: Fowler. Usual Codes.

Frank, Alfred, Mining Engineer. 1121 Newhouse Bldg., Salt Lake City, Utah.

Fuller, John T., Pres., Franklin Fluorspar Co., City National Bank Bldg., Puducah, Kentucky.

G

Gald, Rudolf, Consult. Metallurgist. Specializes in Concentration, Flotation and Leaching of Copper Ores. 1101 Laurel St., Berkeley, Calif.

Garrey, George H., Consulting Mining Geologist and Engineer. Appraisal of possibilities outlining development work, geologic mine maps. Bullitt Bldg., Philadelphia, Pa. Code: Bedford-McNeill.

Gibson, Arthur, Mining Engineer. Placer Mining and Magnetometric Determinations of Mineral Concentrations in the Field. 300 Haight St., San Francisco.

Graham, Stanley N., Mining Engineer. Mining and Metallurgical Dept., Queens University, Kingston, Ont., Canada.

Grant, Wilbur H., Geological and Mining Engineer. 1209 Hobart Bldg., 582 Market St., San Francisco. Code: Bedford-McNeill.

Guess, H. A., Mining Engineer. 120 Broadway, New York City.

H

Hall, R. G., Chemical and Metallurgical Engineer. Complex Ores, Electrolysis. 835 Hyde St., San Francisco, Cal.

Hamilton, Beauchamp and Woodworth, E. M. Hamilton, F. A. Beauchamp, S. E. Woodworth, Consulting Metallurgical Engineers. Office Chancery Bldg., 564 Market St., San Francisco. Telephone: Sutter 5266. Cable Address: Hambeau. Codes: West. Union: Bed. McNeill.

Hamilton, E. M., Metallurgist. Specialty: Cyaniding Gold and Silver Ores, Chancery Bldg., 564 Market St., San Francisco.

Hamilton, Fletcher, Consulting Engineer, Mining and Petroleum. State Mineralogist of California, 1913-1923. Hobart Bldg., San Francisco.

Hamilton, H. T., Consulting Mining Engineer. 1402 California Commercial Union Bldg., San Francisco, Cal.

Hammond, John Hays, Consulting Engineer. 120 Broadway, New York. Code: Bedford-McNeill.

Hardy, J. Gordon, Mining Engineer. Room 1505, 60 Broadway, New York City.

Hatch, Hamlin B., Mining Geologist. Natural Resource Dept., Reid Newfoundland Co., Ltd., St. John's, Newfoundland. Mining Properties, Timber Limits and Water Powers Examined in Newfoundland and Labrador.

Heinz, N. L., Engineer. Design and Erection of Zinc and Sulphuric Acid plants and parts thereof. River Forest, Illinois.

Henderson, H. P., Mining Engineer. 522 Fifth Ave., New York.

Hersey Co., Milton, Ltd., Mining Engineers. Consultion, Examination and Management. 84 St. Antoine St., Montreal, Can. "Milhersey"—Bedford-McNeill Code.

K. F. Hess and C. A. Mette, Consulting Engineers, Mining, Metallurgy, Petroleum, Plant Design, Construction, Operation. 1009 Spring Arcade Bldg., Los Angeles, Calif.

Hoffman, Karl F., Mining Engineer. Cable: Manhoff. Room 1564, 120 Broadway, New York.

Hoffman, Ross B., Mining Engineer. 228 Perry St., Oakland, Cal. Cable: Siberhof.

Holden, Edwin C., Consulting Mining Engineer. 1100 Garrett Bldg., Baltimore, Md. Code: Bedford-McNeill. Cable: "Nedloh." Baltimore.

Hollis, H. L., Consulting Mining Engineer and Metallurgist. 435 Railway Exchange, 80 E. Jackson Blvd., Chicago.

Huntoon, Louis D., Mining Engineer. 2 Rector St., New York. 156 Yonge St., Toronto, Canada.

Hunt Co., Robert W., Mining Engineers. Examinations and Reports of Properties and Processes. Development of Properties. Consultation Assayers and Chemists. Inspection and Tests Materials, Machinery and Structural Steel for Structures. Chicago, Ill.

Hutchinson & Livermore, W. Spencer Hutchinson, Robert Livermore, Mining Engineers. 201 Devonshire St., Boston, Mass.

J

Janin, Charles, Mining Engineer. 716 Kohl Bldg., San Francisco. Cable: Charjan. Code: McNeill.

Jenks, Arthur W., Mining Engineer and Metallurgist. 1305 Bonita Avenue, Berkeley, Cal. Cable: Jenksville.

Johnson, J. Fred, Contract Mine Development and Operation, Consulting Engineer, Eureka, Utah.

Joralemon, Ira B., Mining Engineer and Geologist. 1402 California Commercial Union Bldg., San Francisco, Calif.

Julian, E. A., Mining Engineer. Goldfield Consolidated Mines Exploration Co., Crocker Bldg., San Francisco, Cal.

K

Keene, Amor, F., Consulting Mining Engineer. 42 Broadway, New York. Cable: Kamor, New York.

Kennard Engineering Co., Mining and Metallurgical Engrs. Mill Design and Construction. Filtration. Hollingsworth Bldg., Los Angeles, Cal.

Kennedy, Julian, Engineer. The Bessemer Bldg., Sixth St. and Duquesne Way, Pittsburgh, Penn. Cable Address: "Engineer," Pittsburgh.

Kingsbury, H. M., Mining Geologist, 788 Mills Building, San Francisco.

Kinzie, Robert A., Mining Engineer. First National Bank Bldg., San Francisco, Cal.

Kithil, K. L., Consulting Mining and Industrial Engineer. Rare ores and other ores. Consultation, exploration, ore treatment, management. 728 Ogden St., Denver, Colo.

Knox & Allen, Henry H. Knox, John H. Allen, Mining and Metal Engineers. 160 Broadway, New York. Cable Address: "Allenox." N. Y.

Krejci, Milo W., Consulting Metallurgical Engineer. Smelting and refining of copper and lead. 483 So. Orange Ave., So. Orange, N. J.

Krumb, Henry, Mining Engineer. Felt Bldg., Salt Lake City, Utah.

Kunz, George F., Gem Expert. c/o Tiffany & Co., 401 Fifth Ave., New York.

L

LaBarthe, Jules, Metallurgical Engineer. 85 Second St., San Francisco.

Lakenan, C. B., Mining Engineer. McGill, Nev.

Lasier, Frederick G., Mining Engineer. Holly, Mich., or c/o Detroit Club, Detroit, Mich.

Lawton, Nathan O., Mining Engineer. Examinations, Reports, Management; Years of Experience. 618 Clift. Bldg., Salt Lake City, Utah.

Leggat, Alexander, Mining Engineer, Geologist, Leggat Hotel, Butte, Montana.

Levensaler, L. A., Mining Engineer. 1110 Hoge Bldg., Seattle, Wash.

Lindberg, Carl O., Mining Engineer. 1218 Pacific Mutual Life Bldg., Los Angeles, Cal. Cable: "Carlind." Code: Smelters and Bedford-McNeill.

Lloyd, R. I., Metallurgical Engineer. Specialty: Pyro-Metallurgy of Copper and Associated Metals. 29 Broadway, New York. Cable: Ricloy. Code: McNeill & Miners & Smelters.

Locke, Augustus, Mining Geologist. 788 Mills Bldg., San Francisco, Cal.

Longyear Company, E. J., Mining Engineers. Diamond Core Drilling, Shaft Sinking and Mine Development, Diamond Drill Manufacturing. Security Bldg., Minneapolis, Minn. Cable: Longco. Code: McNeill.

Loring, W. J., Mining Engineer. Specialty: Mine Management and Examination of Mining Properties. Office, Prescott, Arizona, and c/o Bewick Moreing & Co., 62 London Wall, London E. C. 2. Cable: Wantoness. Usual Codes.

Loveman, Michael H., Mining Geologist. 233 Broadway, New York City.

Lucke, P. K., Consulting Mining Engineer. 227 South Salado St., San Antonio, Tex. Cable: Lucke, San Antonio, Tex.

Lunt, Horace F., Mining Engineer. 617 Majestic Bldg., Denver, Colo.

M

MacDonald, H. J. C., Oil and Mining Geologist, Oil and Mine Operating and Valuation Engineer, P. O. Box 1099, Casper, Wyoming.

Marshall, N. C., Mining Engineer. Buenaventura, Colombia, South America.

Mathewson, E. P., Consulting Metallurgist. Non-Ferrous Metallurgy. 42 Broadway, New York. Cable: Bigsmoke.

Mayer, Lucius W., Mining Engineer. Rogers, Mayer & Ball, 42 Broadway, New York. Cable Address: Alhasters.

McDermott, E. D., Mining Engineer. The Dene Boro Green, Kent, England.

McGregor, A. G., Engineer Design of Metallurgical Plants. Warren, Ariz.

McKay, Harry S., Mining Engineer, mine examination and management. Cananea, Sonora, Mexico, Apartado 28.

Mead, H. L., Mining Engineer. American Cyanamid Co., 511 Fifth Ave., New York.

Merrill Company, The, Chas. W. Merrill, Pres. Precipitation Processes, Merco Nordstrom Plug Valves. Merrillite, 121 Second St., San Francisco, Cal.

Miller, Thos. N., Mining Engineer, Tientsin, China. Cable: "Sams." Code: Bentleys. Examinations in Asia only.

Mills & Manning, Inc. Hui Chang Building, Rue Linevitch, Peking, China.

Minard, Frederick H., Mining Engineer. 41 East 42nd St., New York City. Tel.: Murray Hill 9076. Cable: Frednard. Code: McNeill.

Mitke, Charles A., Consulting Mining Engineer. Mine Examinations and Reports, Phoenix, Ariz.

Mudd, Seeley W., Mining Engineer, 1206 Pacific Mutual Bldg., Los Angeles, Cal. Cable Address: Selmud.

Munro, C. H., Mining Engineer. Hobart Bldg., San Francisco. Cable: Ornum.

Munroe, H. S., Mining Engineer, c/o The American Metal Co., Ltd., 61 Broadway, New York.

N

Naething, Foster S., Consulting Mining Engineer, Joplin, Missouri.

Neill, James W., Metallurgist and Mining Engineer, c/o Tokiwa Co., Ltd., Tokyo, Japan. Pasadena, Cal. Salt Lake City, Utah.

Notman, Arthur, Mining Engineer and Geologist. Room 1410, 170 Broadway, New York City.

Nowland, Ralph C. Hobart Bldg., San Francisco, in charge Exploration Dept. of D. C. Jackling.

P

Packard, George A., Mining Engineer and Metallurgist. 50 Congress St., Boston, Mass. Cable Address: "Geopack," Boston.

Payne, Henry Mace, Consulting Mining Engineer, Machinery Club, 50 Church St., New York. Cable Macepayne. Usual codes.

Perry, O. B., Mining Engineer. 120 Broadway, New York.

Pickering, J. C., Mining Engineer. 16 Park Ave., New York City. Cables: Keringpic. Temporary address care The Georgian Manganese Co., Ltd., Tiflis, Georgia, Russia. Cables: Keringpic, Tiflis.

Plate, H. Robinson, Mining Engr. Examination, Development and Management, Holbrook Bldg., San Francisco, Cal. Code: Bedford-McNeill.

Poillon & Poirier, Howard Poillon, C. H. Poirier, Mining Engineers. 42 Broadway, New York.

R

Rakowsky, Victor. Engineer of mines in the development by explorations of the Oklahoma, Kansas, Missouri Zinc-Lead Fields, Joplin, Mo.

Reed, Avery H., Mining Engineer. Consultation and business restricted entirely to the non-metallic mineral fluorspar. Marion, Ky.

Reid, J. A., Mining Engineer and Geologist. 702 Northern Ontario Bldg., Toronto, Ont.

Richards, Gragg, Mining Geologist. 15 Shirley St., Worcester, Mass.

Richards & Locke, Robt. H. Richards, Chas. E. Locke, Min. Engineers. Careful Concentration Tests for Design of Flow Sheets for Difficult Ores, 69 Mass. Ave., Cambridge A, Mass.

Ricketts, L. D., Consulting Engineer. 325 Pacific Southwest Bank Bldg., Pasadena, Cal.

Ritter, A. Etienne, Mining Engineer and Geologist. 408-9 Empire Building, Denver, Colo.

Robbins, P. A. 100 Prospect Ave., Highland Park, Ill. Telephone "Highland Park 529."

Roberts, Milnor, Mining Engineer. The Pacific Northwest, British Columbia and Alaska. University Station, Seattle, Wash.

Rogers, Edwin M., Consulting Mining Engineer. 32 Broadway, New York. Cable: Emrog. Code: McNeill.

Rogers, Mayer & Ball, Allen H. Rogers, Sydney H. Ball, Lucius W. Mayer, Mining Engineers. 42 Broadway, New York. Cable: Alhasters.

Rosewater, W. M., Consulting Mechanical Engineer, Specializing on design and construction of mining dredges. 1700 Keith Building, Cleveland, Ohio.

Rutherford, Forest, Consulting Metallurgist. Ore Smelting Contracts, Investigated, Smelting and Milling of Copper and Lead Ores, Design and Construction. 50 Broad St., Room 1242, N. Y.

S

Saunders, T. Skewes, Mining Engineer. Examination, Consultation and Management. University Club. Bucarcli 35, Mex., D. F., Mex.

Sayre, Robert H., Mining Engineer. Berger & Sayre, 617 Majestic Bldg., Denver, Colo. Usual Codes.

Semple, C. Carleton, Mining Engineer and Metallurgist. Apartado 162, Trujillo, Peru, So. America.

Shaler, Millard K., Mining Geologist and Engineer. 40 Rue Royale, Brussels, Belgium. Cable Address: Milshaler, Bruxelles.

Shaw, S. F. Consulting Petroleum and Mining Engineer, Air Lift Specialist. 301 Terrell Road, San Antonio, Texas.

Short, Frank R., Mining Engineer. 1057 Monadnock Bldg., San Francisco. Cable Address: "Muskeg."

Simonds, F. M., Mining Engineer. 25 Madison Ave., New York.

Simpson, W. E., Mining Engineer. Swastika, Ontario, Canada. Cable: Simpson-Swastika.

Smith, Howard D., Mining Engineer. 15 Broad St., New York.

Smith & Ziesemer, Franklin W. Smith, Ralph A. Ziesemer, Mining Engineers. Bisbee, Ariz. Code: McNeill.

Spearman, Chas., B. Sc., M. A., Consulting Mining Geologist and Engineer. Examinations, reports, etc. Exploration and mining programs. Milling and mill construction. Room 704, Power Bldg., Montreal, Quebec.

Stebbins, Elwyn W., Mining and Metallurgical Engineer. 814 Mills Bldg., San Francisco.

Steele, Heath, Mining Engineer. The American Metal Co., Ltd., 61 Broadway, New York City.

Sterrett, Douglas B., Geologist. Mining, Petroleum. Pioneer Petroleum Co., 616 Palace Bldg., Tulsa, Okla.

Stevens, Arthur W., Mining Engineer. Idaho Copper Corp., Cuprum, Idaho.

Stevens, Frank G. Mining Engineer. 36 Oakmount Road, Toronto, Canada.

Stewart, R. H., Mining and Metallurgical Engineer. Vancouver Block, Vancouver, B. C.

Strauss, Lester W., Engineer of Mines. Casilla 514, Valparaiso, Chile, S. A. Cable: Lestra-Valparaiso. Code: McNeill.

Summerhayes, Maurice W., Mining Engineer. Examinations, Diamond Drill Programs, Development and Management of Properties. Confederation Life Bldg., Toronto, Canada.

Sussman, Otto, Ph.D., Mining Engineer. 61 Broadway, New York.

T

Thomas Kirby, Consulting Engineer, Examinations and Negotiations, Mines, Oil and Natural Resource Properties, 25 Broadway, N. Y. City.

Thorne, W. E., Mining Engineer. 519 Sebastopol Ave., Santa Rosa, Cal. McNeill 1908 Code.

Thornhill and Anderson, Engineers. West Allis Wis., care Allis-Chalmers Mfg. Co. E. B. Thornhill and H. G. S. Anderson. Cable Address: Spongeiron Milwaukee.

Timmons, Colin, Mining Engineer. Modena Utah.

Titcomb, Harold A., Mining Engineer. c/o A Chester Beatty, 25 Broad St., New York. Code: Bedford-McNeill.

Turner, J. K., Mining Engineer, Goldfield Nevada, and 465 I. W. Hellman Bldg., Los Angeles, Cal.

Tyrrell, J. B., Mining Engineer and Geologist. 534 Confederation Life Bldg., Toronto, Canada. 208 Salisbury House, London, E.C., 2, England.

V

Vandegrift, J. A., Consulting Engineer. 115 Broadway, New York City. Cable Address: **Javande, N. Y.**

Van Wagenen, H. R., Mining Engineer. 1035 Van Nuys Bldg., Los Angeles, Calif. Tel. Trinity 4431. Cable address, Vanwagenen.

W

Wallace, Louis R., Mining and Metallurgical Engineer. Forwarding Address: Rancho Santa Fe, California. Bentley's Code.

Ward, William F., Mining Engineer. Compania Mirera Choco-Pacifico Buenaventura. Colombia, South America.

Webber, Morton, Mine Valuation and Development. 165 Broadway, New York.

Weekes, Frederic R., Consult. Mining Engr. The Porcupine Goldfields, Development and Finance Co., Ltd., 407 Canada Cement Co. Bldg., Philips Sq., Montreal, Que.

Wegmann, C. Eugene, D. Sc., Cons. Geologist, Ores, Bauxite, Fluorite, Mediterranean and Scandinavian Countries. 20 Quai Lunel, Nice, France.

Westervelt, William Young, Consulting Mining Engineer. 522 Fifth Ave., New York Cable: Casewest. Code: Broomhall's.

Wheeler, H. A., Mining Engineer. Reports on Oil and Mining Properties. 900 Security Bldg., St. Louis, Mo. Cable: "Wah." St. Louis.

Whitaker & Schlereth, O. R. Whitaker, C. Q. Schlereth, Mining Engineers. 932 Equitable Bldg., Denver, Colo., 25 Broad St., New York.

White, J. E., Consulting Engineer. Bothin Bldg., Santa Barbara, California.

Whitman, Alfred R., Mining Geologist. Underground Programmes. Orebody Problems. Univ. of Cal., Southern Branch, Los Angeles, Cal.

Witherell, Charles S., Metallurgical Engineer. 150 Nassau St., N. Y. Cable: "Metwith." Phone Beekman 4957.

Wolf, Harry J., Mining Engineer. 42 Broadway, New York. Cable: Minewolf. Codes: Bedford-McNeill.

Wright, Charles Will, Mining Engineer. Via Francesco Crispi 10, Rome (6). Tel. 14-85. Telegraphic Address: Minesplor, Rome.

Wroth, James S., Mining Engineer. Room 827, 2 Rector St., New York.

Wyman, Henry, Consulting Metallurgist. Zacatacus, Zac., Mexico.

Y

Yeatman & Berry, Pope Yeatman, Edwin S. Berry, Consulting Mining Engineers. Examination, Development and Management of Properties. Room 2030 165 Broadway, New York. Cable: Ikona. Code: Bedford-McNeill.

Z

Zalinski, Edward R., Mining Engineer. 524 Newhouse Bldg., Salt Lake City. Examination Geological Mapping Development.

Ziege, M. E., Economic Mining and Oil Geologist. Facts and truth only. Financing. Tonopah, Nev.

ASSAYERS, CHEMISTS AND ORE-TESTING WORKS

A

Atkin & McRae, Assayers, Chemists and Metallurgists, Control and Umpire Assays. Flotation and Cyanide Tests. 747 S. Hill St., Los Angeles, Cal.

B

Bardwell, Alonzo F., Custom Assayer and Chemist, 158 S. W. Temple St., Salt Lake City, Utah. Ore Shippers' Agent.

Baverstock & Payne, Industrial Chemists and Assayers. Technical and Chemical Analysis of Ores, Minerals and all Organic Materials. 552 So. Figueroa St. Los Angeles, Cal.

Black & Deason, Assayers and Chemists. 165 South West Temple St., Salt Lake City, Utah.

Burlingame, & Parker, Est. 1866. Assayers and Chemists, Ore Shippers' Agent. Testing Laboratory, 1915 Lawrence St., Denver, Colo.

C

Critchett & Ferguson, Assayers and Chemists. El Paso, Texas. Umpire and Controls a Specialty.

E

Ely, E. Prop. Dover Laboratory, Analysts, Assayers. Reports, Gold Assay, $2.00; Iron det. $1.00; Phos., $1.50. Dover, N. J.

F

Frost, Oscar J., Assayer and Chemist. 1310-12 17th Ave. P. O. Box 145, Denver, Colo.

G

Gibson, Walter L., Successor to Falkenau Assaying Co. Assay Office and Analytical Laboratory, School of Assaying, 824 Washington St., Oakland, Cal. Phone: 8929. Umpire assays and supervision of sampling. Working tests of ores, analysis. Investigations of metallurgical and technical processes.

General Engineering Co., J. M. Callow, Pres. The Consulting Engineers. 159 Pierpont St., Salt Lake City, Utah. Design and erection of all classes of reduction plants. Ores tested in small or 5-ton lots by amalgamation, concentration, cyanidation magnetic separation, flotation. Metallurgical bulletin mailed upon request. New York Office, 50 Broad St., Room 1242. C. E. Chaffin, Local Manager. Australian Agent, F. H. Jackson, 40 King St., Sydney, N.S.W., Australia.

Glover, Inc., A. L., successors to Glover, Wells & Elmendorf, Inc. Analysts, Assayers, Metallurgists, 615 Prefontaine Bldg., Third and Yesler Sts., Seattle, Wash.

Goodall Bros., Archie J. Goodall, Assayer and Chemist; H. H. Mayer, Mining Engineer. Customs Assayers, Examinations and Reports, Ore Testing, Shipper's Representatives. Control and Umpire Work a Specialty. Helena, Montana.

H

Hanks, Abbot A., Inc., Chemists and Assayers. 624 Sacramento St., San Francisco, Calif. Control and Umpire Assays, Supervision of Sampling at Smelters. Inspection and Testing of building materials.

Hawley & Hawley, Assayers, Chemists, Ore Buyers, Shippers' Representatives. Box 151, Douglas, Ariz.

L

I. F. Laucks, Inc., Chemists, Assayers, Metallurgists, Ore Testing. Umpire Sampling Import & Export Ore Shipments, 99 Marion St., Seattle, Wash.

Ledoux & Co., Inc., Assayers, Chemists and Metallurgists. Independent Samplers at the Port of New York. Representatives at all Refineries and Smelters on Atlantic Seaboard. Office and Laboratory, 99 John St., New York.

M

Moore, Geo. A. & Co., Assayers and Chemists, 212 California St., San Francisco. Control and Umpire Assays, Complete Ore Testing Laboratory, 615 University Ave., Berkeley, Calif.

O

Officer & Co., R. H., Ore Shippers' Service. Engineers' Assays, Controls, Umpires Iron and Steel, Oil and Coal Analyses. 169 S. W. Temple St., Salt Lake City, Utah.

P

Piers, W. L., Assayer and Chemist. Rare Metals and Analyses. 1736 Glenarm St., Denver, Colo.

Pitkin, Inc., Lucius, Weighers, Samplers and Assayers of Ores of all Descriptions. 47 Fulton St., New York. Cable: Niktip.

R

Richards & Son, J. W., Assayers and Chemists. 1118 19th St., Denver. Ore Shippers' Agent. Write terms. Representatives at Colo. smelters.

Root & Simpson, Successors to Leonard & Root, established 1902. Assayers and Metallurgical Chemists. 1744 Broadway, Denver, Colo.

S

Sill & Sill, Mining and Metallurgical Engineers. 1011 South Figueroa St., Los Angeles. Examinations, Management, Geology, Ore Testing, Research, Mill Design. Consulting Engineers and Managers for Mining and Milling Operations. Metallurgical Plant equipped for large scale test work.

Smith, Emery & Co., Control and Umpire Assayers. Represent Shippers at Smelters. Test Ores and Design Mills. Offices and Laboratories—San Francisco and Los Angeles.

Southwestern Engineering Corp., Consulting Engineers. Ore treatment tests up to 5 tons. Mills designed, erected and operated. Hollingsworth Bldg., Los Angeles, Cal.

Swedish American Prospecting Corp., 42 Broadway, New York City. Rogers, Mayer & Ball, Consulting Engineers. Sole licensee for North, South and Central America under the Lundberg, Sundberg and Conklin patents for making electrical and electromagnetic investigations to locate mineral deposits. Cable: Isopotent.

U

Union Assay Office, Inc., Assayers and Chemists. Box 1446, Salt Lake City, Utah.

W

Waring & Williams, Industrial and Analytical Chemists. Analyses, Tests, Metals, Ores, Zinc-Lead Reports. Joplin, Mo.

Wilder, R. T., and Randall, M. A., Umpire and Control Chemists. Apartado 33, Chihuahua, Mexico.

Wood Assaying Co., Henry E., established 1878, Assayers and Chemists. 1750 Arapahoe St., Denver, Colo. P. O. Box 1318.

At Left: Drifting With a
SULLIVAN "E"
DIAMOND DRILL
Underground
Diamond Drilling
is a cheap way to block out ore bodies. Our Contract Drilling Department will do it for you. Booklet 2122.
Sullivan Machinery Co.
126 S. Michigan Ave., CHICAGO.

AINSWORTH
PRECISION BALANCES AND SURVEYING INSTRUMENTS
THE PRECISION FACTORY
Send for Descriptive Literature
Bulletin A-8 of Balances and Weights
Catalog B-8 of Surveying Instruments
Bulletin C-8 of Improved Brunton Transit

Big Blast Hole Drills For Open Pit Mining
CYCLONE DRILLS
Churn Drills for Prospecting and Placer Work
THE SANDERSON-CYCLONE DRILL CO., Orrville, O.

THE DORR COMPANY
ENGINEERS
247 PARK AVENUE NEW YORK CITY
DENVER LOS ANGELES CHICAGO WILKES-BARRE JOPLIN
THE DORR CO. LTD 16 South Street London E.C.2
DORR G. m.b.H. Joachimsthalerstr. 10, Berlin W.15
SOC. DORR ET CIE. 126, Rue de Provence Paris 6
INVESTIGATION TESTS DESIGN EQUIPMENT

We prospect Mineral, Coal and Oil Lands
We test foundations for bridges, dams, buildings, etc.
PENNSYLVANIA Drilling Co.
812 West Carson St. Pittsburgh, Pa.
Diamond Core Drill Contractors

DIAMOND CORE DRILLING
Metals—Non-metallics—Coal or Oil
Straight Contract
Rental or Cost plus basis
Our service is world-wide
Egildson Bros. Co., Inc.
Newhouse Bldg., Salt Lake City, Utah

Diamond Drill Contracting on Footage or Rental Basis
Manufacturers of
Diamond Core Drills, Parts and Accessories
INTERNATIONAL DIAMOND DRILL CONTRACTING CO.,
Main Office, 501-2 Hobart Bldg., San Francisco, Calif.
Shop E 2127 Hoffman Ave., Spokane, Washington

CLEVELAND ROCK DRILLS
Sinkers—Drifters—Stopers—Augerjacks—Paving Breakers
Steel—Hose—Accessories See our ad in last week's issue
The Cleveland Rock Drill Co., 3734 East 78th St., Cleveland, O.

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in this Issue

For Alphabetical Index See Last Page

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Engineering and Mining Journal-Press* assumes no responsibility for errors or omissions.

Acetylene Generating Apparatus
Oxweld Acetylene Co.

Acid, Sulphuric
Amer. Zinc & Chemical Co.
Illinois Zinc Co.
Matthiessen & Hegeler Zinc Co.

Aerial Tramways
American Steel & Wire Co.
Broderick & Bascom Rope Co.

Aftercoolers, Air
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Agitators
Allis-Chalmers Mfg. Co.
Dorr Co., The

Amalgamators
Allis-Chalmers Mfg. Co.
Bunting Iron Works

Analytical Apparatus
Braun Corporation
Braun-Knecht-Heimann-Co.

Arsenic
Amer. Smelting & Refining Co.
United Metals Selling Co.
U. S. Smelting, Refining & Mining Co.

Ash Handling Equipment
Combustion Engrg. Corp.

Assayers
Baker & Co., Inc.

Bag Houses
Wiederholdt Const. Co.

Balances
Ainsworth & Sons Co.
Braun Corporation
Braun-Knecht-Heimann-Co.

Balls for Ball Mills
Hardinge Co.

Barges, Steel
American Bridge Co.

Bars, Iron and Steel
Ryerson & Son, Inc., Jos. T.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Tapered
Timken Roller Bearing Co.

Bearings, Thrust
Timken Roller Bearing Co.

Belt Fasteners
Bristol Co., The
Flexible Steel Lacing Co.

Belting, Conveyor
Stephens-Adamson Mfg. Co.
U. S. Rubber Co.

Belting, Elevator
Robins Conveying Belt Co.
U. S. Rubber Co.

Belting, Transmission
U. S. Rubber Co.

Black Diamonds
Patrick, R. P.

Blasting Supplies
Du Pont de Nemours Co., Inc., E. I.

Blowers
Connersville Blower Co.
Coppus Engineering Corp.
Roots Co., The P. H. & F. M.

Blowers, Centrifugal
Ingersoll-Rand Co.

Blowing Engines
Nordberg Mfg. Co.

Blowpipes, Welding & Cutting
Oxweld Acetylene Co.

Boilers
Abendroth & Root Mfg. Co.

Books, Technical
McGraw-Hill Book Co.

Breaker Machinery
Vulcan Iron Works

Brick, Chrome
Harbison-Walker Refractories

Brick, Fire
Harbison-Walker Refractories

Bridges, Steel
American Bridge Co.

Bridges, Suspension
Roebling's Sons Co., J. A.

Broker
Butler, L. C.

Buckets, Dredging and Excavating
Marion Steam Shovel Co.
Taylor-Wharton Iron & Steel Co.

Buckets, Elevator
Stephens-Adamson Mfg. Co.

Buckets, Gear
Wellman-Seaver-Morgan Co.

Buildings
Wiederholdt Const. Co.

Buildings, Steel
American Bridge Co.

Cables, Wire
Williamsport Wire Rope Co.

Cableways
Roebling's Sons Co., J. A.

Cages, Hoisting
Atlas Car & Mfg. Co.
Car Dumper & Equip. Co.

Car Dumpers, Rotary
Car Dumper & Equip. Co
Wellman-Seaver-Morgan Co.

Car Hauls
Car Dumper & Equip. Co.
Stephens-Adamson Mfg. Co.
Wellman-Seaver-Morgan Co.

Car Tipples
Wellman-Seaver-Morgan Co.

Carbons and Bortz
Diamond Drill Carbon Co.
Patrick, R. P.

Carbon Rods Paste for Welding
Oxweld Acetylene Co.

Cars, Gable Bottom
Atlas Car & Mfg. Co.
Watt Car & Wheel Co.

Cars, Hopper
Atlas Car & Mfg. Co.
Watt Car & Wheel Co.

Cars, Mine
Koppel Ind. Car & Equip. Co.
Mt. Vernon Car Mfg. Co.
Watt Car & Wheel Co.

Cars, Mine Roller Bearing
Ottumwa Iron Works

Cars, Ore
Atlas Car & Mfg. Co.
Koppel Ind. Car & Equip. Co.
Mt. Vernon Car Mfg. Co.
Watt Car & Wheel Co.

Cars, Quarry
Atlas Car & Mfg. Co.
Austin Mfg. Co.
Watt Car & Wheel Co.

Castings, Iron and Steel
Marion Steam Shovel Co.
Nuttall Co., R. D.
Pacific Foundry Co.
Vulcan Iron Works

Chains, Transmission
Stephens-Adamson Mfg. Co.

Chemical Apparatus
Braun Corporation
Braun-Knecht-Heimann-Co.
Oliver Cont. Filter Co.

Chemicals
Braun Corporation
Braun-Knecht-Heimann-Co.

Chimneys
Wiederholdt Const. Co.

Chimneys, Acid Proof
Custodis Chimy. Cons. Co., A.

Chimneys, Radial Brick
Custodis Chimy. Cons. Co., A.

Clarifiers
Hardinge Co.

Classifiers
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.
Deister Machine Co.
Dorr Co., The

Clutches, Friction
Stephens-Adamson Mfg. Co.

Coal Cutters
Ingersoll-Rand Co.
Sullivan Machy. Co.

Coal and Ore Handling Machinery
Stephens-Adamson Mfg. Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Nordberg Mfg. Co.
Oliver Cont. Filter Co.
Worthington Pump & Machy. Corp.

Compressors, Air Portable
Ingersoll-Rand Co.
Sullivan Machy. Co.

Compressors, Gasoline
Sullivan Machy. Co.

Concentrators, Table
Allis-Chalmers Mfg. Co.
Bunting Iron Works
Deister Concentrator Co.
Deister Machine Co.

Condensers
Ingersoll-Rand Co.
Nordberg Mfg. Co.
Southwestern Engrg. Corp.

Controllers
Electric Controller & Mfg. Co.

Converters, Horizontal and Vertical
Allis-Chalmers Mfg. Co.

Conveyors and Elevators
Allis-Chalmers Mfg. Co.
Stephens-Adamson Mfg. Co.

Conveyors, Belt
Robins Conveying Belt Co.
Stephens-Adamson Mfg. Co.

Conveyors, Portable
Robins Conveying Belt Co.

Copper
American Metal Co.
American Smlg. & Refg. Co
Balbach Smlg. & Refg. Co.
Nichols Copper Co.
U. S. Smelting, Refining & Mining Co.

Copper Sulphate
Irvington S. & R. Co.
Nichols Copper Co.

Cordage, Manila & Sisal
Plymouth Cordage Co.

Core Drills, Diamonds
Patrick, R. P.

Couplings, Air Hose
Cleveland Rock Drill Co.

Cranes
Milwaukee Crane & Mfg. Co.

Crucibles
Bullard Co., E. D.

Crushers
Allis-Chalmers Mfg. Co.
Austin Mfg. Co.
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Colorado Iron Works Co.
Smith Engrg. Works
Stephens-Adamson Mfg. Co.

Crusher Parts
Era Steel Co.

Crushers, Coal
Vulcan Iron Works

Cups, Grease (See "Grease Cups")

Cutting Apparatus, Oxy-Acetylene
Oxweld Acetylene Co.

Cyanide
Braun Corporation
Braun-Knecht-Heimann-Co.

Dealers, Machinery (Rails, Pipe & Misc. Equipment)
Butchart Milling Co.
Consolidated Prod. Co.
Eastern Iron & Metal Co.
Hyman-Michaels Co.
Machinery Sales Agency
Morse Bros. Machy. & Supply Co.
Nashville Industrial Corp.
Rosenburg & Co.
Thyle Machinery Co.
United Commercial Co.
U. S. Machy. & Steel Co.

Decarbonizing Apparatus
Oxweld Acetylene Co.

Dewaterers
Oliver Cont. Filter Co.
Thyle Machinery Co.

Diamonds, Black (See "Carbons and Bortz")

Diamond Drilling, Carbon
Patrick, R. P.

Dredges
Marion Steam Shovel Co.
Union Construction Co.
Yuba Mfg. Co.

Dredges, Dipper and Hydraulic
Bucyrus Co.

Dredges, Elevator
Marion Steam Shovel Co.

Dredges, Placer
Bucyrus Co.
New York Engineering Co.

Drilling, Core
Egildson Bros. Co., Inc
Pennsylvania Drilling Co.
Sullivan Machinery Co.

Drilling, Diamond
Egildson Bros Co., Inc.
Int. Diamond Drill Cont'g. Co.

Drilling, Diamonds for
Patrick, R. P.

Drills, Air and Steam
Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
Cochise Rock Drill Mfg. Co.
Ingersoll-Rand Co.

Drills, Churn
Union Construction Co.

Drills, Core
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Diamond
Sullivan Machinery Co.

Drills, Electric
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Hammer
Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
Cochise Rock Drill Mfg. Co.
Denver Rock Drill Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Piston
Cochise Rock Drill Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Prospecting
Ingersoll-Rand Co.
New York Engineering Co.
Sanderson-Cyclone Drill Co.
Sullivan Machinery Co.

Dryers
Ruggles-Coles Engrg. Co.
Shriver & Co., T.

Dryers, Coal
Vulcan Iron Works

Dryers, Ore
Allis-Chalmers Mfg. Co.

Dryers, Sand & Coal
Ruggles-Coles Engr'g Co.

Dumps, Rotary
Car Dumper & Equip. Co.

Dust Collecting Systems and Engineers
Dust Recovering and Conveying Co.

Dust Protectors (See "Respirators")

Dynamite
Du Pont de Nemours Co., Inc., E. I.

Electric Transmission Towers
American Bridge Co.

Electrical Supplies
Ohio Brass Co.

Elevators
Austin Mfg. Co.

Elevators, Bucket
Stephens-Adamson Mfg. Co.

Employment Agency
Business Men's Clearing House

Engineers, Metallurgical
Dorr Co., The
Southwestern Engrg. Corp.

Engines, Diesel
Allis-Chalmers Mfg. Co.
Nordberg Mfg. Co.
Worthington Pump & Machy. Corp.

Engines, Gas and Gasoline
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Thyle Machinery Co.
Wellman-Seaver-Morgan Co.
Worthington Pump & Machy. Corp.

Engines, Hoisting
Ottumwa Iron Works

Engines, Oil
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Nordberg Mfg. Co.

Engines, Steam
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Nordberg Mfg. Co.

Excavating Machinery
Marion Steam Shovel Co.

Excavators, Dragline
Bucyrus Co.
Marion Steam Shovel Co.

Exhausters
Coppus Engineering Corp.

Explosives
Du Pont de Nemours Co., Inc., E. I.

Explosives, Permisable
Du Pont de Nemours Co., Inc., E. I.

Fans, Ventilating
Coppus Engineering Corp.
Ottumwa Iron Works
Vulcan Iron Works

Feed Water Heaters
Worthington Pump & Machy. Corp.

Feeders, Ore
Bunting Iron Works
Colorado Iron Works Co.
Hardinge Co.
Southwestern Eng'r'g Corp.
Stephens-Adamson Mfg. Co.

Filter Cloth
United Filters Corp.

Filter Paper
Braun Corporation
Braun-Knecht-Heimann-Co.

Filters
Colorado Iron Works Co.
Oliver Cont. Filter Co.

Filters, Cloth Metallic
Nat'l Filter Cloth & Weaving Co.
Oliver Cont. Filter Co.
United Filters Corp.

Filters, Concentrate
Oliver Cont. Filter Co.
United Filters Corp.

Filters, Cyanide
Oliver Cont. Filter Co.
United Filters Corp.

Flotation Cell Bottoms, Cloth
Filter Fabrics Co.
Simpson Engineering Co.

Flotation Machines
Bunting Iron Works
Hardinge Co.
Simpson Engineering Co.
Southwestern Engrg. Corp.

Flotation Oils
General Naval Stores Co.

Flotation Reagents
Great Western Electro Chem. Co.

Flues
Wiederholdt Const. Co.

Flux, Welding
Oxweld Acetylene Co.

Forges, Rock Drill Steel
Ingersoll-Rand Co.
Sullivan Machinery Co.

Furnaces, Assay
Braun Corporation
Braun-Knecht-Heimann-Co.

Furnaces, Crucible Tilting Metal
Braun Corporation
Braun-Knecht-Heimann-Co.

Furnaces, Electric
American Bridge Co.
Braun Corporation
Braun-Knecht-Heimann-Co.

Furnaces, Heat Treatment
Braun Corporation
Braun-Knecht-Heimann-Co.

Furnaces, Laboratory
Nichols Copper Co.

Furnaces, Mechanical Roasting
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.
Dwight & Lloyd Sintering
Nichols Copper Co.
Pacific Foundry Co.

Furnaces, Melting
Braun Corporation, The
Braun-Knecht-Heimann-Co.

Furnaces, Smelting
Allis-Chalmers Mfg. Co.
Combustion Engrg. Corp.

Gages
Bristol Co., The

Gates, Traveling
Combustion Eng. Corp.

Gears
Era Steel Co.
Farrel Foundry & Mch. Co.
Nuttall Co., R. D.
Stephens-Adamson Mfg. Co.
Vulcan Iron Works

Gears, Cut and Worm
Cleveland Worm & Gear Co.

Gears, Double Helical
Farrel Foundry & Mch. Co.

Gears, Herringbone
Farrel Foundry & Mch. Co.

Gear Reducers
Farrel Foundry & Mch. Co.

Gravel Washing Plants
Stephens-Adamson Mfg. Co.

Grinders, Air and Electric
Chicago Pneumatic Tool Co.

Grinders, Chemical Ore
Braun Corporation
Braun-Knecht-Heimann-Co.
Cleveland Rock Drill Co.

Grinders, Ore
Hardinge Co.
Williamson Co.

Hammers, Forging
Sullivan Machy. Co.

Hammers, Pneumatic
Cleveland Rock Drill Co.

Headlights, Incandescent Mine
Ohio Brass Co.

Hoists, Air
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hoists, Chain
Wright Mfg. Co.

Hoists, Electric
Allis-Chalmers Mfg. Co.
Nordberg Mfg. Co.
Ottumwa Iron Works
Vulcan Iron Works
Wellman-Seaver-Morgan Co.

Hoists, Friction
Austin Mfg. Co.

Hoists, Portable
Ingersoll-Rand Co.
Sullivan Machy. Co.

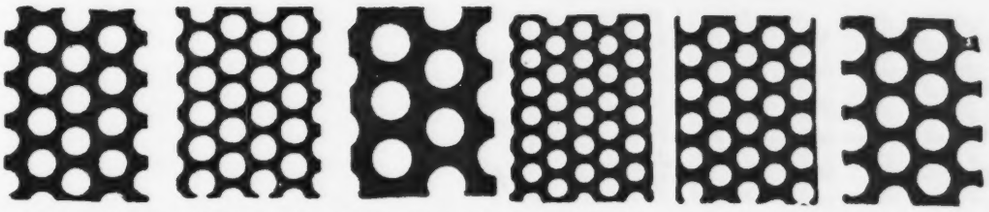
Hoists, Room
Vulcan Iron Works

Hoists, Steam
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Nordberg Mfg. Co.
Ottumwa Iron Works
Vulcan Iron Works

Hose
Cleveland Rock Drill Co.

PERFORATED METAL

All sizes and shapes of Holes



All kinds and thicknesses of Metal

FOR SCREENING ORES—ROCK—GRAVEL—SAND—COAL AND ALL MINERALS

The Harrington & King Perforating Company

5641 Fillmore St., Chicago, Ill., U. S. A. New York Office: 114 Liberty Street

---

Ryerson Steel

Bars, Shapes, Plates — Shafting, Tubes, Rivets — Bolts and Nuts, Boiler Fittings, Reinforcing Steel — Corrugated Sheets, Galvanized Sheets, Babbitt, etc.

Write for Journal and Stock List.

JOSEPH T. RYERSON & SON INC. CHICAGO DETROIT ST. LOUIS BUFFALO CINCINNATI NEW YORK

Marion POWER SHOVELS

All types: steam, electric, gasoline-electric; convertible to draglines, or cranes. Details on request.

Marion Steam Shovel Co., Marion, Ohio

ROBINS CONVEYORS

have stood *the test of time* in mining plants the world over.

ROBINS CONVEYING BELT COMPANY
15 Park Row, New York

Your Name

in this space in all issues where larger display space is not used backs up your advertising campaign and keeps your name in the alphabetical index.

SCREENS OF ALL KINDS

Chicago Perforating Co.
2445 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

THERMOLITH
FIRE CEMENT
"Makes the Weakest Point the Strongest"
HARBISON-WALKER REFRACTORIES
World's Largest Producers of Refractories
Pittsburgh, Pa. U.S.A.

PERFORATED METAL SCREENS

For Every Purpose

Elevated Buckets
Light and Heavy Steel Plate Construction

HENDRICK MFG. CO., Carbondale, Pa.
New York Office 30 Church St. — Hazleton, Pa., Office 705 Markle Bank Bldg. — Pittsburgh, Pa. 954 Union Trust Bldg.

B.&B. AERIAL TRAMWAYS

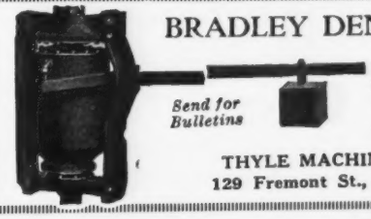
BRODERICK & BASCOM ROPE CO.
Seattle ST. LOUIS New York
J 505

DREDGES FOR GOLD AND TIN

UNION CONSTRUCTION CO.
351 California St., San Francisco, Cal.

Neill Jigs—Union Churn Drills

BRADLEY DENSITY VALVE



automatically controls the underflow of any thickener, dewaterer or settler.

Send for Bulletins

THYLE MACHINERY COMPANY
129 Fremont St., SAN FRANCISCO

YUBA PLACER DREDGES

Yuba Ball Tread Tractors. Yuba Centrifugal Pumps.

YUBA MANUFACTURING COMPANY
Works: Marysville, Cal. Sales Offices: 433 California Street San Francisco, Cal.
Cable Address: YUBAMAN—All Codes

Excavating Machinery

Bucyrus Company, South Milwaukee, Wis.

BUCYRUS

New York Chicago Birmingham San Francisco Pittsburgh Tokyo London 723

Hose, Air
Cochise Rock Drill Mfg. Co.
Denver Rock Drill Mfg. Co.
Ingersoll-Rand Co.
U. S. Rubber Co.

Hydraulic Giants
Amer. Spiral Pipe Works

Hydraulic Supplies
Amer. Spiral Pipe Works

Hydraulic Trip Controls
Car Dumper & Equip. Co.

Instruments, Surveying
Ainsworth & Sons Co.

Insulating Material, Electric
Ohio Brass Co.

Jackets, Water
Allis-Chalmers Mfg. Co.

Jigs
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.

Kilns, Rotary
Allis-Chalmers Mfg. Co.

Kilns, Rotary Ore Nodulizers
Ruggles-Coles Engr'g. Co.

Laboratory Machinery
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Oliver Cont. Filter Co.

Lamp Guards
Flexible Steel Lacing Co.

Lamps, Acetylene
Braun Corporation
Braun-Knecht-Heimann-Co.
Bullard Co., E. D.
Dewar Mfg. Co.

Lead
American Metal Co.
American Smlg. & Ref. Co.
Balbach Smelting & Refining Co.
St. Joseph Lead Co.
United Metals Selling Co.
U. S. Smelting, Refining & Mining Co.

Line Material, Overhead
Ohio Brass Co.

Linings, Ball and Tube Mill
Allis-Chalmers Mfg. Co.
Hardinge Co.

Loaders, Mechanical
Nordberg Mfg. Co.

Locomotives, Electric
Vulcan Iron Works

Locomotives, Electric Storage Battery
Atlas Car & Mfg. Co.
Mancha Storage Batt. Loco. Co.
Vulcan Iron Works

Locomotives, Gasoline
Fate-Root-Heath Co.
Vulcan Iron Works

Locomotives, Industrial
Fate-Root-Heath Co.

Locomotives, Mine
Fate-Root-Heath Co.

Locomotives, Steam
Vulcan Iron Works

Machine Tools
Ryerson & Son, J. T.

Magnets
Dings Magnetic Separator Co.

Magnets, Lifting
Electric Controller & Mfg. Co.

Magnetic Pulleys
Dings Magnetic Separator Co.

Manganese Steel
Taylor-Wharton Iron & Steel Co.

Manila Drilling Cables
Plymouth Cordage Co.

Metals, Perforated
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Harrington & King Perforating Co., The
Hendrick Mfg. Co.

Mills, Ball, Tube and Pebble Rod (also parts)
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.
Era Steel Co.
Filter Fabrics Co.
Hardinge Co.
United Filters Corp.
Williamson Company

Mills, Stamp
Allis-Chalmers Mfg. Co.

Mineral Magnetic Separators
Dings Magnetic Separator Co.

Mining Machinery (Muleback Transportation)
Roy & Titcomb, Inc.

Mixers
Smith Eng. Works

Monel Metal
International Nickel Co.

Motor, Generator Sets
Atlas Car & Mfg. Co.

Motors
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.

Nickel
Amer. Smelting & Refining Co.
International Nickel Co.
Nichols Copper Co.

Nodulizers, Ore
Allis-Chalmers Mfg. Co.

Oil, Pine
General Naval Stores Co.

Oil Storage Tanks
American Bridge Co.

Ore, Buyers and Sellers of
American Metal Co.
Am. Smelting & Refining Co.
Amer. Zinc & Chemical Co.
Associated Metals & Minerals Co.
Balbach Smlg. & Ref. Co.
Bartlesville Zinc Co.
Illinois Zinc Co., The
International Smelting Co.
Irvington Smelting & Refining Works
Matthiessen & Hegeler Zinc Co.
Phelps-Dodge Corp.
U. S. Metals Refining Co.
United States Smelting Refining & Mining Co.

Ore Dryers
Ruggles-Coles Engr'g. Co.

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.

Oxy-Acetylene Supplies
Oxweld Acetylene Co.

Packing
U. S. Rubber Co.

Packing, Rod
U. S. Rubber Co.

Packing, Sheet
U. S. Rubber Co.

Perforated Metals
(See Metals, Perforated)

Pipe Flanges, Forged Steel
Amer. Spiral Pipe Works

Pipe, Forge Welded
Amer. Spiral Pipe Works

Pipe, Spiral, Riveted
Abendroth & Root Mfg. Co.
Amer. Spiral Pipe Works

Platinum
Baker & Co., Inc.

Pneumatic Hammers
Chicago Pneumatic Tool Co.

Pneumatic Tools
Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
Ingersoll-Rand Co.

Powder Blasting
Du Pont de Nemours Co., Inc., E. I.

Power Transmission, Mchy.
Stephens-Adamson Mfg. Co

Precipitation, Electrical
Western Precipitation Co.

Preheating Apparatus
Oxweld Acetylene Co.

Preservative, Wood (See Creosote)

Presses, Filter
Oliver Cont. Filter Co.
Shriver & Co., T.

Publishers, Technical Book
McGraw-Hill Book Co.

Pulleys, Magnetic
Acme Magneto Pulley Co.
Dings Magnetic Separator Co.
Magnetic Mfg. Co.

Pulverized Fuel Equipment
Combustion Engrg. Corp.

Pulverizers, Coal
Braun Corporation
Braun-Knecht-Heimann-Co.
Combustion Engrg. Corp.
Hardinge Co.

Pulverizers, Ore
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Colorado Iron Works Co.
Hardinge Co.

Pumping Engines
Nordberg Mfg. Co.
Prescott Co., The

Pumps, Acid
Byron Jackson Pump Mfg. Co.
Oliver Cont. Filter Co.

Pumps, Boiler Feed
Byron Jackson Pump Mfg. Co.

Pumps, Centrifugal
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Krogh Pump & Machy. Co.
Oliver Cont. Filter Co.
Wilfley & Sons, A. R.
Worthington Pump & Machy. Corp.

Pumps, Deep Well
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Krogh Pump & Mchy. Co.

Pumps, Electric
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Krogh Pump & Mchy. Co.
Oliver Cont. Filter Co.
Prescott Co., The
Wilfley & Sons, A. R.

Pumps, Hydraulic
Prescott Co., The

Pumps, Mill
Byron Jackson Pump Mfg. Co.
Colorado Iron Works Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Krogh Pump & Machy. Co
Oliver Cont. Filter Co.
Prescott Co., The
Roots Co., The P. H. & F. M.
Wilfley & Sons, A. R.

Pumps, Mine
Allis-Chalmers Mfg. Co.
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Krogh Pump & Mchy. Co.
Prescott Co., The
Roots Co., The P. H. & F. M.

Pumps, Pneumatic Air Lift
Ingersoll-Rand Co.
Sullivan Machinery Co.

Pumps, Power Plant
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Prescott Co., The
Roots Co., The P. H. & F. M.
Worthington Pump & Machy. Corp.

Pumps, Reciprocating
Prescott Co., The

Pumps, Sand, Slime and Tailings
Byron Jackson Pump Mfg. Co.
Dorr Co., The
Krogh Pump & Machy. Co.
Wilfley & Sons, A. R.

Pumps, Sinking
Byron Jackson Pump Mfg. Co.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Prescott Co., The

Pumps, Steam
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)
Oliver Cont. Filter Co.
Prescott Co., The
Worthington Pump & Machy. Corp.

Pumps, Vacuum
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Ingersoll-Rand Co.
Roots Co., P. H. & F. M.
Sullivan Machinery Co.

Pyrometers
Bristol Co., The

Rail Bonds
American Steel & Wire Co.
Ohio Brass Co.

Rail Bonding Tools
Ohio Brass Co.

Rails and Rail Fittings
Ryerson & Son, Inc., Jos. T.

Receivers, Air
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Refractories
Braun Corporation
Braun-Knecht-Heimann-Co.

Regulators, Compressed Gas
Oxweld Acetylene Co.

Regulators, Gas
Western Precipitation Co.

Respirators
Diamond Rubber Co.

Rolls, Crushing
(See "Crushers")

Rods, Welding
Oxweld Acetylene Co.

Rope, Manila, Hoisting, Transmission
Plymouth Cordage Co.
Williamsport Wire Rope Co.

Rope, Wire
American Steel & Wire Co.
Broderick & Bascom Rope Co.
Hazard Mfg. Co.
Leschen & Sons Rope Co., A.
Roebling's Sons Co., John A.
Williamsport Wire Rope Co.

Safety Appliances
Bullard Co., E. D.

Safety Magnets
Dings Magnetic Separator Co.

Samplers, Ore
Allis-Chalmers Mfg. Co.
Galigher Machy. Co.

Screens, Incline, Vibratory
Deister Concentrator Co.

Screens
Allis-Chalmers Mfg. Co.
Austin Mfg. Co.
Colorado Iron Works Co.
Chicago Perforating Co.
Harrington & King Perforating Co., The
Hendrick Mfg. Co.
Stephens-Adamson Mfg. Co.

Screens, Perforated Metal
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.

Screens, Revolving
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.
Harrington & King Perforating Co., The
Stephens-Adamson Mfg. Co.

Screens, Vibrating
Deister Concentrator Co.
Southwestern Engrg. Corp.

Second-Hand Machinery (See Searchlight Section)
Butchart Milling Co.
Consolidated Prod. Co.
Eastern Iron & Metal Co.
Hyman-Michaels Co.
Machinery Sales Agency
Morse Bros. Mach. & Supply Co.
Nashville Industrial Corp.
Rosenburg & Co.
Thyle Machy. Co.
United Commercial Co.
U. S. Machy. & Steel Co.

Selenium
Amer. Smelting & Refining Co.

Separators, Magnetic
Acme Magnetic Pulley Co.
Dings Magnetic Separator Co.
Magnetic Mfg. Co.

Separators, Ore
Magnetic Mfg. Co.

Sharpeners, Drill
Denver Rock Drill Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Shovels, Electric
Marion Steam Shovel Co.

Shovels, Gasoline
Marion Steam Shovel Co.

Shovels, Power
Bucyrus Co.

Shovels, Steam, Gas and Electric (also parts)
Era Steel Co.
Marion Steam Shovel Co.

Sintering Apparatus
Dwight & Lloyd Sintering Co.

Skips
Atlas Car & Mfg. Co.
Wellman-Seaver-Morgan Co.

Smelters
American Smlg. & Ref. Co.
Balbach Smlg. & Ref. Co.
Illinois Zinc Co.
International Smelting Co.
Matthiessen & Hegeler Zinc Co.
Nichols Copper Co.
U. S. Metal Selling Co.
U. S. Smelting, Refining & Mining Co.

Spelter
Amer. Metal Co., Ltd., The
Amer. Smelt. & Ref. Co.
U. S. Smelting, Refining & Mining Co.

Starters
Electric Controller & Mfg. Co.

Steel, Bars, Sheets, Plate, etc.
Ryerson & Son, J. T.

Steel, Drill
Chicago Pneumatic Tool Co.
Colonial Steel Co.
Ingersoll-Rand Co.

Steel, High-Speed
Colonial Steel Co.

Steel, Hollow & Solid
Colonial Steel Co.

Steel, Manganese
Era Steel Co.
Taylor-Wharton Iron & Steel Co.

Steel, Tool
Colonial Steel Co.

Stokers, Hand
Combustion Engrg. Corp.

Stokers, Mechanical
Combustion Engrg. Corp.

Structural Steel
American Bridge Co.
Ryerson & Son, J. T.

Thickeners
Dorr Co., The
Hardinge Co.
Thyle Machinery Co.

Torches, Welding & Cutting
Oxweld Acetylene Co.

Trackshifters
Nordberg Mfg Co.

Tractors
Yuba Mfg. Co.

Tramways, Aerial
Williamsport Wire Rope Co.

Tramways, Wire Rope, Aerial
Broderick & Bascom Rope Co.
Hazard Mfg. Co.
Leschen & Sons Rope Co., A.
Roebling's Sons Co., J. A.

Transformers, Electric
Allis-Chalmers Mfg. Co.

Transportation
Roy & Titcomb

Trolley Line Material
Ohio Brass Co.

Turbines, Hydraulic
Allis-Chalmers Mfg. Co.
Worthington Pump & Machy. Corp.

Turbines, Steam
Allis-Chalmers Mfg. Co.

Turntables
American Bridge Co.

Valves
Cleveland Rock Drill Co.
Thyle Machinery Co.

Valves, Back Pressure
Oxweld Acetylene Co.

Valves, Rubber Pump
U. S. Rubber Co.

Ventilating Apparatus
Dust Recovering & Conveying Co.

Welders, Portable Electric
Ohio Brass Co.

Welding Apparatus
Bullard Co., E. D.

Welding and Cutting Apparatus, Oxy-Acetylene
Oxweld Acetylene Co.

Welding Supplies
Oxweld Acetylene Co.

Wheels & Axles, Car
Watt Car & Wheel Co.

Wire
Williamsport Wire Rope Co.

Wire, Flat, Round and Special Shape
Amer. Steel & Wire Co.
Roebling's Sons Co., John A.

Wire, Insulated
Hazard Mfg. Co.
Roebling's Sons Co., John A.
U. S. Rubber Co.

Wire Rope Fittings
Hazard Mfg. Co.
Roebling's Sons Co., John A.
Williamsport Wire Rope Co.

Wire Rope Slings
Hazard Mfg. Co.
Roebling's Sons Co., John A.

Wire, Welding
Oxweld Acetylene Co.

Wood Borers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Wood Preservative (See Creosote)

Wrenches, Alligator
Roebling's Sons Co., J. A.

Xanthate
Great Western Electro Chem. Co.

Zinc
American Metal Co.
United Metals Selling Co.

Zinc Dust
American Metal Co.
American Smlg. & Ref. Co.
Amer. Zinc & Chemical Co.
Bartlesville Zinc Co.
Braun Corporation
Braun-Knecht-Heimann-Co.
U. S. Metals Refining Co.

Zinc Oxide
American Metal Co.
Amer. Zinc & Chemical Co.
Bartlesville Zinc Co.
U. S. Metals Refining Co.

Zinc, Sheet
Illinois Zinc Co.
Matthiessen Hegeler Zinc Co.

Zinc Sulphate
Amer. Smlg. & Ref. Co.

Simpson Pneumatic Flotation Cell

Write for Bulletin

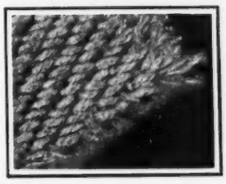
Differential Flotation of Lead-zinc and other complex ores. Low operating and upkeep costs. High extraction.

Simpson Engineering Co., Long Beach, Calif.

"High Duty" Magnetic Separation

Perhaps, you would like to ask a few questions regarding a certain difficult problem in your plant. Let us tell you if it can be done by Magnetic separation. Trained engineers and 25 years' experience are yours to command. Think it over.

MAGNETIC MFG. CO.,
237—24 Ave., Milwaukee, Wis.



Flotation Cell Blankets

2, 3 and 4 ply woven into ONE piece, and Seamless Filter Cloth for Oliver Filter Presses.

National Filter Cloth & Weaving Co.
134 Broadway, Brooklyn, N. Y.

TELSMITH CRUSHERS

GYRATORY AND JAW TYPES

Pillar-shaft Gyratory Breakers, Reduction Crushers, Cast Steel Jaw Crushers, Elevators, Screens, Belt Conveyors, Etc.

Write for Catalog 168

SMITH ENGINEERING WORKS

84 Lake Boulevard, Milwaukee, Wis.

AUSTIN GYRATORY CRUSHERS

Portable and Stationary Plants
Capacities, 5 to 300 tons per hour

AUSTIN MANUFACTURING CO.
New York CHICAGO San Francisco

DEISTER-OVERSTROM

Diagonal-Deck Tables for Ore Concentration

Leahy **NO-BLIND** Vibrating Screens

THE DEISTER CONCENTRATOR COMPANY
FORT WAYNE, INDIANA

SHRIVER FILTER PRESSES

Write for catalogue, stating filtration problems

T. SHRIVER & CO.
526 Hamilton St., Harrison, N. J.

FLOTATION OILS

No. 5 PINE OIL The Long-Established Standard Pine Oil

Effective Oils of Each Class

PINE—HARDWOOD—COAL TAR OILS

General Naval Stores Co., 90 West St., New York

BALL ROD & TUBE MILLS

Built right in every particular. The heavy shells and heavy heads and trunnions give strength to meet the most severe conditions.

Made in a variety of sizes, and driven in various ways. Write for pamphlet No. 31-B.

Colorado Iron Works Co.
Denver, Colo.
New York Office: 30 Church Street

Specify **OLIVER**

For economy in your filtering operation *Write for information*

OLIVER CONTINUOUS FILTER CO.
San Francisco, 501 Market St. New York, 33 W. 42nd St. London, 11 Southampton Row

With a Dings it costs little to catch all that iron

Dings High Intensity MAGNETIC SEPARATION

Dings Magnetic Separator Co., 673 Smith St., Milwaukee, Wis.

COTTRELL PROCESS

ELECTRICAL PRECIPITATION

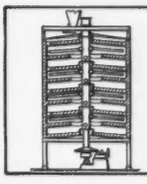
Calder-Fox Scrubber *Reineke Draft Regulator*

WESTERN PRECIPITATION COMPANY
Chemical Engineers
1016 W. Ninth St., LOS ANGELES 25 W. 43d St., NEW YORK

Use PLAT-O TABLES

For Ore Concentration and Coal Washing

DEISTER MACHINE CO.
Fort Wayne, Ind.



ROASTING FURNACES
NICHOLS – HERRESHOFF

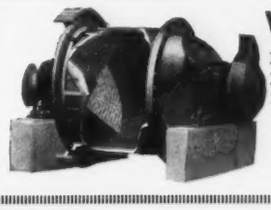
CAST IRON CORROSIRON FOUNDRIES
MONEL METAL FLINTCAST MACHINE WORK

PACIFIC FOUNDRY COMPANY
HARRISON & 18TH STS., SAN FRANCISCO.

XANTHATE For FLOTATION

Insist on "Bear Brand"
For uniformity and best results.
Great Western Electro Chemical Co.
9 Main St., San Francisco, Calif.
Cable Address: Chlor

GREAT WESTERN ELECTRO CHEMICAL CO. BEAR BRAND PRODUCTS SAN FRANCISCO



Williamson Ball Mills

Increases grinding capacity of balls.
Decreases the power required.
Reduces wear of balls and liners.

Write for bulletin.

Williamson Company
Hobart Bldg., San Francisco, Calif.

ALPHABETICAL INDEX TO ADVERTISEMENTS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Engineering and Mining Journal-Press* assumes no responsibility for errors or omissions.

	Page
Abendroth & Root Mfg. Co.	26
Acme Magnetic Pulley Co.	30
Ainsworth & Sons, Wm.	37
Allis-Chalmers Mfg. Co.	4
American Bridge Co.	24
American Cont. Filter Co. (See United Filters Corp.)	21
American Metal Co., Ltd., The	31
American Smelting & Refining Co.	29
American Spiral Pipe Works	26
American Steel & Wire Co.	26
American Well Works	15
American Zinc & Chemical Co.	28
Associated Metals & Minerals Corp.	28
Atlas Car & Mfg. Co., The	26
Austin Mfg. Co.	41
Baker & Co., Inc.	28
Balbach Smelting & Refining Co.	28
Bartlesville Zinc Co.	28
Braun Corporation, The	30
Braun-Knecht-Heimann Co.	30
Bristol Co., The	20
Broderick & Bascom Rope Co.	39
Bucyrus Co.	39
Bullard Co., E. D.	42
Bunting Iron Works	25
Byron Jackson Pump Mfg. Co., Inc.	20
Cameron Steam Pump Works, A. S. (Ingersoll-Rand Co.)	25
Car Dumper & Equipment Co.	26
Chicago Perforating Co.	39
Chicago Pneumatic Tool Co.	22
Cleveland Rock Drill Co.	37
Cleveland Worm & Gear Co.	25
Cochise Rock Drill Mfg. Co.	21
Colonial Steel Co.	19
Colorado Iron Works Co.	41
Combustion Engr'g Corp.	26
Connersville Blower Co., The	34
Coppus Engineering Corp.	22
Custodis Chimney Cons. Co., A.	24
Deister Concentrator Co., The	41
Deister Machine Co.	41
Denver Rock Drill Mfg. Co., The	5
Dewar Mfg. Co.	34
Diamond Drill Carbon Co., The	42
Dings Magnetic Separator Co.	41
Dorr Co., The	37
Du Pont de Nemours & Co., Inc., E. I.	12
Dust Recovering & Conveying Co., The	14
Dwight & Lloyd Sintering Co., Inc.	30
Egildson Bros. Co., Inc.	37
Electric Controller & Mfg. Co.	27
Era Steel Co.	30
Farrell Foundry & Machine Co.	13
Fate-Root-Heath Co., The	26
Filter Fabrics Co., The	42
Flexible Steel Lacing Co.	27
General Naval Stores Co.	41
Great Western Electro Chemical Co.	41
Harbison-Walker Refractories	39
Hardinge Co.	16
Harrington & King Perforating Co., The	39
Hazard Mfg. Co.	23
Hendrick Mfg. Co.	39
Illinois Zinc Co.	30
Ingersoll-Rand Co., (A. S. Cameron Steam Pump Works)	25
International Diamond Drill Contracting Co.	37
International Nickel Co., The	30
International Smelting Co.	31
Irvington Smelting & Refining Works	30
Kelly Filter Press Co. (See United Filters Corp.)	21
Koppel Industrial Car & Equipment Co.	26
Krogh Pump & Mchy. Co., The	27
Leschen & Sons Rope Co., A.	26
Lissausers Cie., M.	28
McGraw-Hill Book Co., Inc.	17
Magnetic Mfg. Co.	41
Mancha Storage Battery Locomotive Co.	26
Marion Steam Shovel Co., The	39
Matthiessen & Hegeler Zinc Co.	30
Milwaukee Electric Crane & Mfg. Co.	26
Mt. Vernon Car Mfg. Co.	26
National Filter Cloth & Weaving Co.	41
New York Engineering Co.	30
Nichols Copper Co.	30
Nordberg Mfg. Co.	Third Cover
Nuttall Co., R. D.	6
Ohio Brass Company	34
Oliver Continuous Filter Co.	41
Ottumwa Iron Works	34
Oxweld Acetylene Co.	18
Pacific Foundry Co.	41
Patrick, R. S.	27
Pennsylvania Drilling Co.	37
Phelps-Dodge Corporation	30
Plymouth Cordage Co.	8
Prescott Co., The	9
Professional Directory	35-37
Robins Conveying Belt Co.	39
Roebling's Sons Co., John A.	24
Roots Co., The P. H. & F. M.	26
Ruggles-Coles Engineering Co.	16
Ryerson & Son, Inc., Jos. T.	39
Sanderson Cyclone Drill Co.	37
Searchlight Section	32, 34
Second Hand Equipment	32, 34
Shriver & Co., T.	41
Simpson Engineering Co.	41
Smith Engineering Works	41
Southwestern Engineering Corporation	24
Stephens-Adamson Mfg. Co.,	Second Cover
Sullivan Machinery Co.	7, 37
Sweetland Filter Press Corp. (See United Filters Corp.)	21
Taylor-Wharton Iron & Steel Co.	30
Thyle Machinery Co.	39
Timken Roller Bearing Co.	Fourth Cover
Union Construction Co.	39
United Filters Corp.	21
United Metals Selling Co.	31
United States Metals Refining Co.	31
United States Rubber Co.	24
United States Smelting, Refining and Mining Co.	29
Vulcan Iron Works	10
Watt Car and Wheel Co., The	22
Wellman-Seaver-Morgan Co., The	34
Western Precipitation Co.	41
What and Where to Buy	38-40
Wiederholdt Construction Co.	24
Wilfley & Sons, A. R.	24
Williamson Co.	41
Williamsport Wire Rope Co.	11
Worthington Pump & Machinery Corp.	23
Wright Mfg. Co.	27
Yuba Mfg. Co.	39

INDEX TO SEARCHLIGHT SECTION

Butchart Milling Co.	32
Butler, L. C.	32
Denver Metal & Mchry Co.	33
Eastern Iron & Metal Co.	34
Hassenstein & Vogler	32
Hyman Michaels Co.	33
Machinery Sales Agency	33, 34
Morse Bros.	33
Nashville Industrial Corp.	32, 33, 34
Positions Vacant	32
Positions Wanted	32
Rosenburg & Co.	33
Roy & Titcomb Inc.	32
United Commercial Co.	33
U. S. Machinery & Steel Co.	33
Utah Copper Co.	34
Wanted Ads	32

FLOTATION
Blankets of any size for Pneumatic Machines; Best 10 years ago; Best today; Prompt delivery.

The Filter Fabrics Co.
SALT LAKE CITY, UTAH.

FILTRATION
Filter cloths in variety; American Filter Bags; Oliver Filter Covers; Special cloths or bags to order; Burlap, Cocoa Matting, etc.

Why you should use tested carbon in your diamond core drills!

No sharp corners—easy to set—assures maximum footage — quality guaranteed. Write or wire at our expense for catalog and full particulars.

The Diamond Drill Carbon Co.
67 Park Row, New York, N. Y. Cable Address: Credotan, N. Y.

PACIFIC COAST HEADQUARTERS FOR MINE SAFETY EQUIPMENT

Carbide
Mine Lamps
Flare Lights
Oxy-Acetylene Apparatus, Etc.

E.D.BULLARD CO.
HOME OFFICE 565 Howard St San Francisco Cal
SOUTHERN BRANCH 802-West 11th St. Los Angeles Cal.

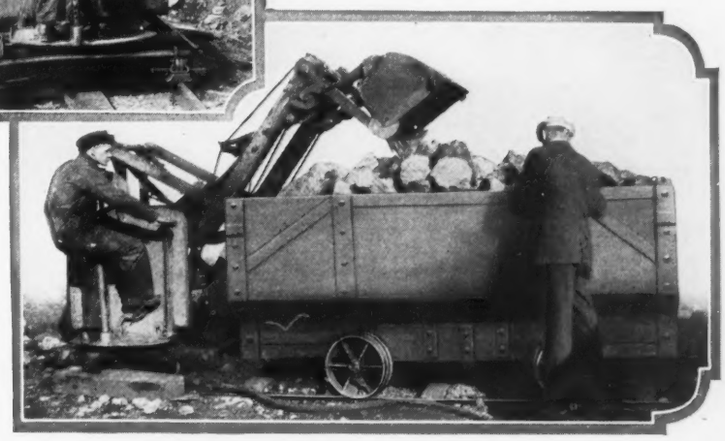
Gibbs
Rescue Stations
Goggles—Respirators
Bartley Crucibles
Etc.

This view shows the dipper after it has been crowded into the pile, the dipper rotated and filled, ready to be raised and revolved.

A low cost, air operated, full revolving, underground shovel that cleans up a path 18 feet wide yet will operate in a 5½ foot drift.

The dipper is raised in a position for revolving. In this position the machine requires a tunnel 5 ft. 6 in. wide, with 6 ft. 6 in. head room.

The dipper has been extended fully to the dumping position. Note the reach over the 9-foot car.



The New Butler Shovel

Low First Cost
Wide Field of Service
Dependable in Performance

Are you using, or contemplating using mechanical means for loading ore or rock underground? If so, the cost of such equipment, its performance and its adaptability for any service are points that you must consider.

Nordberg has now developed a shovel that will meet all these requirements. Its low first cost is comparable with that of any other type of underground loading equipment. The underlying thought in the design of this machine was to build a machine of low cost and one that would have such widespread use that it would permit of quantity production.

This new Butler Shovel has other advantages besides low cost. It can be moved quickly from level to level or to different working faces and headings. Compare its air consumption of 135 cubic feet per minute with any other form of air operated loading equipment. It will work equally well in narrow drifts or in large stopes. Regardless of your past experience with mechanical loaders, the performance of the Butler will surprise you.

Write us regarding your conditions. Perhaps a Butler Shovel will solve your loading problems. Bulletin GG-10 describes this new Shovel.

Nordberg Mfg. Co., Milwaukee, Wis., U.S.A.

NORDBERG MACHINERY

NORDBERG

NORDBERG MACHINERY

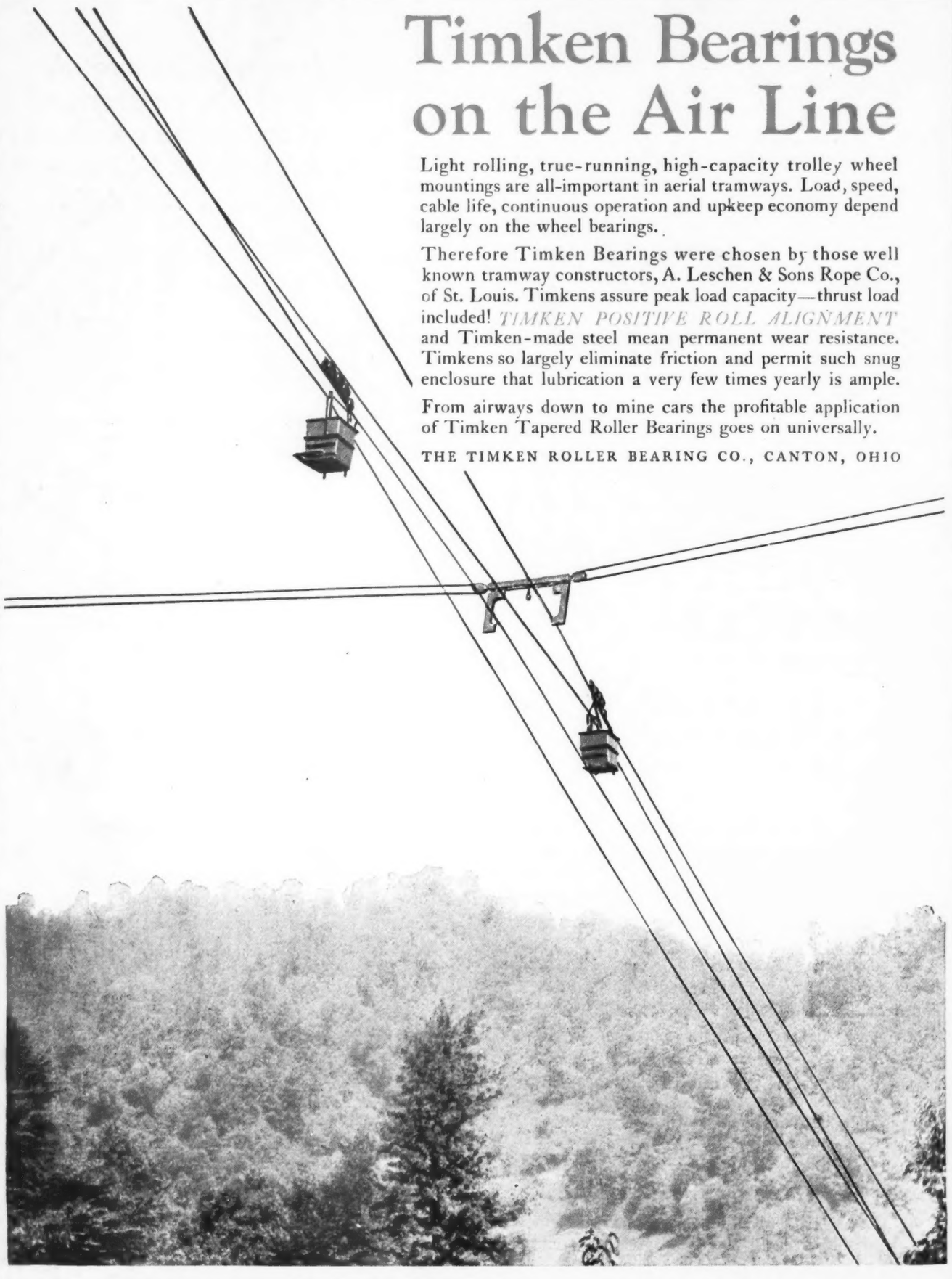
Timken Bearings on the Air Line

Light rolling, true-running, high-capacity trolley wheel mountings are all-important in aerial tramways. Load, speed, cable life, continuous operation and upkeep economy depend largely on the wheel bearings.

Therefore Timken Bearings were chosen by those well known tramway constructors, A. Leschen & Sons Rope Co., of St. Louis. Timkens assure peak load capacity—thrust load included! *TIMKEN POSITIVE ROLL ALIGNMENT* and Timken-made steel mean permanent wear resistance. Timkens so largely eliminate friction and permit such snug enclosure that lubrication a very few times yearly is ample.

From airways down to mine cars the profitable application of Timken Tapered Roller Bearings goes on universally.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO



TIMKEN *Tapered Roller* **BEARINGS**